Methods of Filling Teeth with Gold Inlays.*

By Dr. Thomas P. Hinman, Atlanta, Ga.

Molars and Bicuspids Compound Cavities.

In molars or bicuspids where there is considerable loss of the approximo-occlusal surface the cavity is prepared very much the same as in smaller cavities of the same character.

The neck between the body of the filling and the doll-head should be large enough to pass a No. 7 round burr. Of course, the cavity should be so formed that the matrix may be dislodged easily, thus preventing a change of shape during its removal.

The matrix is formed as usual in cavities of this description. It may be swaged directly against the margins with the orangewood plugger. Remove the matrix from the cavity and thicken with 22-K. solder, trim, return to the cavity and reburnish, always being careful to see that there are no tears in matrix at the margins. Remove in a modeling compound impression and bite, run the model in sump and place in a small crown articulator. Restore the lost parts in hard wax, carving the cusp to suit the occlusion. Over this occlusal portion of the wax, burnish annealed 1-1000 pure gold, it being so soft that it can easily be carried into the smallest grooves. Just before the tooth is cut from the model, bring the articulator together, so as to press the gold thoroughly against the wax.

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If the gold does not stick to the wax, it can be made to do so with a hot burnisher. Trim the occlusal gold to the marginal lap of the matrix and to the knuckle of the adjoining tooth. Cut the tooth from the model. Before investing, raise a portion of the gold from the surface, covering the dollhead to allow for the attachment of a small roll of wax one-sixteenth of an inch in diameter, one-quarter of an inch long. This small roll of wax should pass distally, and is to be used to make a vent-hole for the solder. (Fig. 41.)

Wet the model and proceed to invest, placing the roll of wax downward, covering the coronal surface of the gold completely and all the tooth, except the wax over the approximal surface. When the investment is hard, trim the model as small as possible to retain strength. Cut away on the under side until you strike the roll of wax. Boil out the wax.

FIG. 41.

FIG. 42.

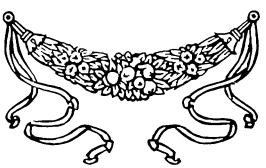
(Fig. 42.) Flux the inside of the gold mould and proceed to fill with small pieces of solder, the pieces of solder introduced being thoroughly flowed before attempting to add any additional, 20-K. solder being used for this purpose.

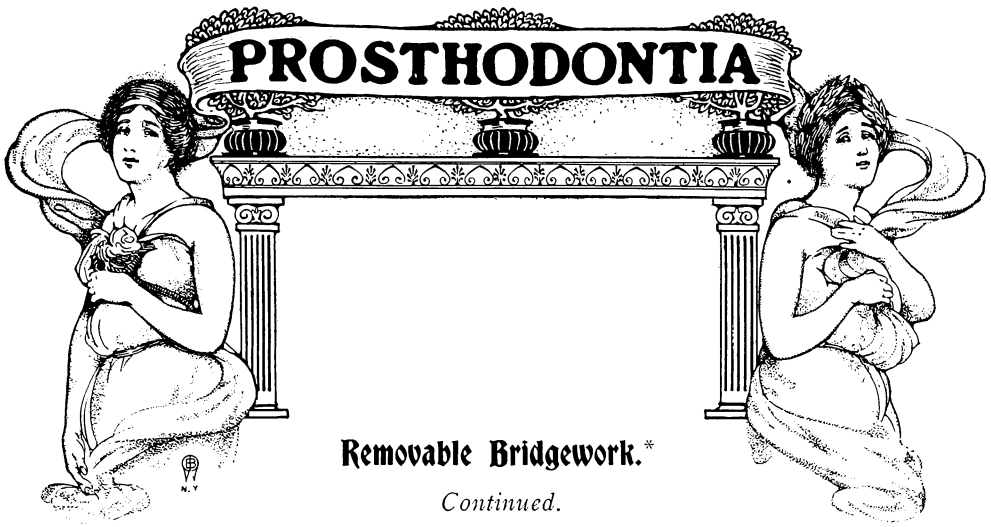
The object of the vent-hole made by the roll of wax is to prevent any air from being caught in the bottom of the mould, thus causing bubbles.

Continue to add solder until the approximal surface is level full. Thus you have an inlay with the occlusal surface practically finished. Pickle, trim and polish, allowing only a slight lap at the margins. The approximal surface in these cavities are always finished before setting, except the slight lap at the cervical margins. This is trimmed down with a strip after the inlay has been set. If the occlusion is not perfect (and it usually is slightly high) it may be ground down with a small corundum stone.

Deep sulci may be restored, cutting away the gold with a round burr. If the cavity be a very deep one, it is wise to cut away a portion of the gold next to the pulp, thus allowing a greater thickness of cement at this point.

In cases of deep cusps, fillings made after this manner hold their restored cusps permanently, while in cases of hammered fillings the cusp if restored, in most instances, either batter down or break off. The method here described is used by the author only in cases where a considerable restoration of the occlusal surface is required, but may be used in any cavity involving the approximo-occlusal surfaces.





Removable Bridgework.*

Continued.

By Hart J. Goslee, D.D.S., Chicago, Ill.

Patented and Manufactured Attachments.

Several patented and manufactured "systems" of attachment for removable bridgework and partial dentures have been more or less generally employed, and while none of them has by any means succeeded in entirely revolutionizing the construction of this class of work, some have been abandoned, while others are doubtless practicable and may often be employed with success.

These attachments vary considerably in design, but are usually composed of two parts which telescope into or over each other, one of which is to be securely attached to the supporting tooth, and the other to the removable fixture.

Advantages. The advantages which are to be derived from the use of such forms of attachment lie in the facility with which anchorage to the supporting teeth may be obtained; in the more or less secure means of fixation which they afford; in the fact that the parts are usually *machine-made,* and, therefore, accurately adjusted in their relation to one another, and that they may be obtained ready for immediate use directly from the manufacturer or dealer, thus saving the expenditure of time and energy in devising a means of otherwise retaining such pieces.

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Disadvantages.

Notwithstanding the numerous possible advantages, however, such attachments as are even yet used and recommended are neither universally applicable, nor, as a rule, free from objectionable features. These are usually, first, *inherent weakness,* which results in their soon becoming broken; second, a demand for such precise and accurate parallelism when two are to be on a single piece, as to require the use of a paralleling instrument, and the exercise of a greater degree of skill than is ordinarily possessed by the average dentist, thus making their use too intricate and uncertain; third, the extent of space occupied by the attachment itself, and obtained at the expense of the adjustment of the teeth to be supported by the fixture; fourth, the possible subsequent loosening of the parts in their inter-relation, as a result of continued friction and stress, which may soon render them useless; fifth, a lack of provision or opportunity for easily overcoming this, or for tightening the adjustment; and sixth, the leverage imposed upon the supporting teeth, which may be so severe as to result in their subsequent loosening, or ultimate loss.

Indications.

Whenever opportunity for minimizing these objectionable features seems to present, and whenever suitable anchorage teeth remain in the mouth, and the form of attachment best adapted to the case is judiciously selected, and properly and skilfully adjusted, such attachments may be successfully employed.

The Roach Attachment.

Although among the most recently devised, the form of attachment designed by Dr. F. E. Roach, of Chicago, and known as the Roach Attachment, is among the strongest, simplest and most generally applicable methods, and is given precedence over all similar forms, for the following reasons:

First, the area of actual contact between the parts of the attachment in their relation to each other is so small that, while the fixture is more or less rigidly retained, yet some degree of mobility is afforded, and thus the leverage or tipping strain thrown upon the supporting teeth is greatly reduced.

Second, this small area of contact allows considerable latitude in the adjustment of the parts, and absolutely accurate paralleling is, therefore, not required, thus simplifying the adjustment and overcoming the need for employing a paralleling instrument.

Third, the attachment possesses a maximum of strength, and yet, in proportion thereto, as compared with similar forms, it occupies a minimum of space.

Fourth, the parts may be used interchangeably on either the "fixed" or *"removable"* part of the piece, and are also equally applicable to fillings or crowns; or to porcelain, gold or vulcanite work, thus increasing the range of application and usefulness.

Fifth, in the event of subsequent loosening they may be easily tightened, and opportunity for accommodating the fixture to an almost unlimited degree of subsequent settlement is also afforded.

The Attachment. The Roach attachment comprises two parts which may be described as follows: Part 1 is a slotted round tube of 26 gauge gold clasp metal (Fig. 390-A), and part 2 is a solid ball with a projecting stem for attachment to the denture (Fig. 390-B). The stem has a shoulder near the

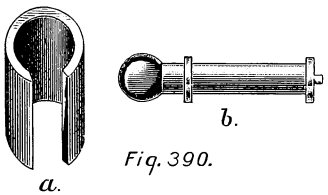


Fig. 390.

ball which serves the dual purpose of strength and finishing line, and the extreme end of the stem has a large head for secure anchorage in vulcanite work.

The ball end of part 2 accurately engages into part 1, and the rigidity of the spring metal of which the tube is made maintains a continuous tension on the *circumference* of the ball, thus affording a firm anchorage for the denture, yet admitting of some little play or mobility.

Application to Vulcanite Work. As applied to vulcanite work having made the abutment pieces in the form of either gold telescope, or open-faced, or of porcelain-faced, or all porcelain dowel crowns, take the "bite" in wax and the impression in plaster, with the crowns in place, removing the latter with the impression. Fill the inside of crowns with wax, run model, and then remove the crowns from model, clean out the wax from inside of them, replace them on model and wax, part 1, to place on crown. If a gold crown the tube may be held, while soldering, with a pair of round-end tweezers as in Fig. 391, but when a dowel crown with porcelain

facing and gold back, or of porcelain, as illustrated in Fig. 392, or a gold inlay, is used for abutment piece, investment will, of course, be necessary.

After tubes are soldered on, the crowns should be placed on model, part 2 adjusted to place, and the teeth waxed up, being *careful to have the first tooth in good contact with the abutment crown.* Then flask the case so that crowns, attachment and teeth all come away together in one side of the flask, leaving only the model on the other side. Part 2 should now be removed and the tube, part 1, filled with *cement* and part 2 put back in place. The inside of the tube should be well filled, and a thin layer of the cement should also be placed all over the outside and up to the shoulder on part 2.

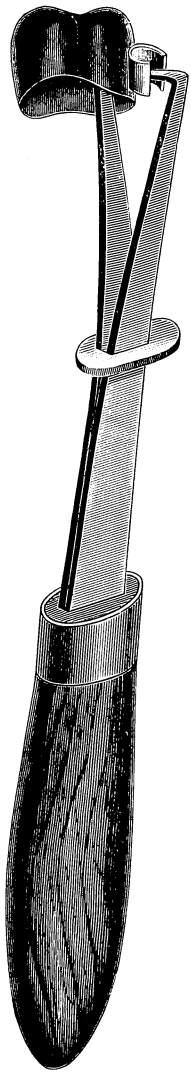


Fig. 391.

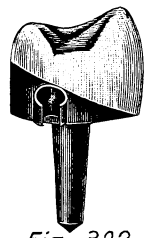


Fig. 392.

This luting of the joints is necessary to prevent the ingress of the vulcanite.

Application to Gold or Porcelain Work.

As applied to gold or porcelain work the procedure is the same as above indicated except, of course, that a metal die and counter-die must be made and the saddle swaged, after which the saddle is placed on the model and the ball (part 2) adjusted to its proper place in the tube and in relation to the saddle, and secured to the latter with hard wax. The saddle, with part 2 thus attached, should now be carefully removed from model, invested and soldered. Saddle and abutment crowns should then be adjusted to position in the mouth, and a good combination "bite"

and impression in wax will then be sufficient for the completion of the case in the usual manner in either gold or porcelain. In running this model, however, do not flow wax in crowns, as it is desirable to have them held securely on model.

Application to Gold Inlays.

Where gold inlays are to be used for abutment pieces for vulcanite cases, the typical application of which is illustrated in Fig. 393-A, flasking will of necessity vary. In such cases the abutment pieces and attachments will have to remain on the model side in flask, and to

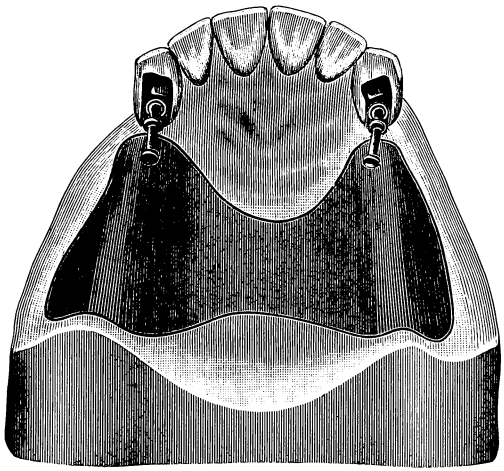


Fig. 393. A.

prevent undue shifting of stem of attachment, it will be necessary to carefully pack rubber between it and the model before closing the flask. Figure 393-B, shows a typical type of construction in which the attachment is made both to an inlay in the cuspid, and to a gold crown on the molar.

Precautions.

An observation of the following precautions will greatly facilitate the application of these attachments.

First. If the tube (Part 1), is placed so that it will be in alignment with the lingual surface of the teeth, and well down toward the gum, it will thus be entirely out of the way in all cases.

Second. In soldering the tubes to the abutment pieces do not attempt to do so until you have the latter on a good accurate model, as they can then be placed in proper position to much better advantage. Then wax them where you want them, and grasp them with soldering tweezers as illustrated; or remove and invest, as the case may be.

Third. In cases made of gold with vulcanite attachment it is usually a good plan to first solder the attachment to the saddles and then take a good combination "bite" and impression in wax, with the base and abutment pieces all in position.

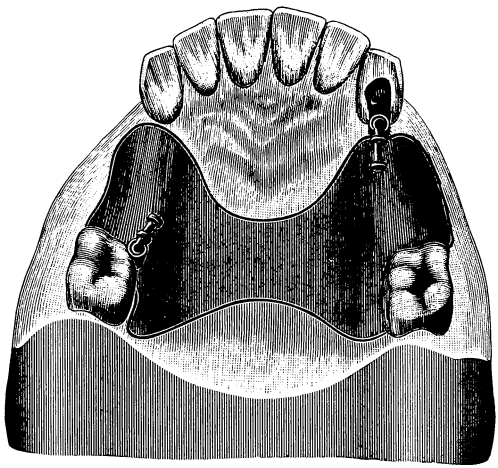


Fig. 393. B.

Fourth. In cases where the abutment pieces have already been cemented in the mouth, part 2 should be put to place with a bit of wax between *stem* and *gum* and a plaster impression taken. If it does not come away with the impression, remove and carefully place it where it belongs therein, and then slip a duplicate tube over ball and run up model. This supplemental tube should be about half an inch in length so that it will securely hold part 2 in place on the model during the construction of the case.

Fifth. Should the head on the stem interfere with the proper adjustment of the first tooth it may be filed off on that side without injury. For a very close bite a "saddle-back" tooth placed next to the supporting tooth may be used to advantage.

Variations. In cases where it would seem advantageous to reverse the application of the parts, and anchor the *ball* instead of the *tube,* to the abutment piece, or even to the *crown* of a *natural tooth,* that may be done. Indeed the latter application which is illustrated in Fig. 394, is often a most useful procedure. In such cases a hole the size and depth of the stem of part 2 is drilled into the tooth with a drill provided for this purpose, and the surface of the tooth around the hole then faced off so that the shoulder on the pin will set flat against the tooth. The head on the end of the stem will, of course, have to be filed off, and the stem must be filed flat on one side and thoroughly roughened, to prevent the possibility of becoming loosened afterward, when it may be cemented to place. The tube in such cases must then be secured to the denture by soldering an extension of wire or heavy plate to it.

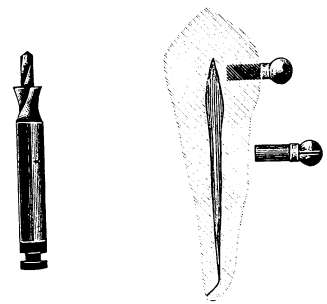


Fig. 394.

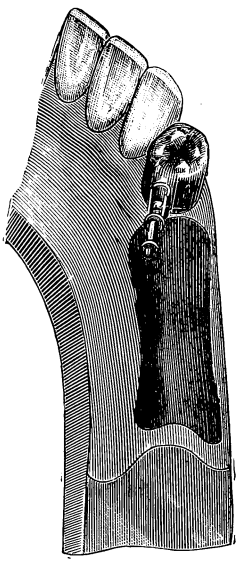


Fig. 395.

Fig. 395 illustrates a not uncommon case where a single attachment would answer the purpose, provided the ridge were high, and prominent, and the bite not too long, and more extensive cases with outline of saddle, or base, indicated, and in which this method of attachment would be particularly and typically useful are illustrated in Fig. 396. A and B.

Mounting. As a rule the permanent mounting of the abutment piece with cement, should be made after the attachment has been finally secured to and becomes a part of the removable piece. They should then be mounted simultaneously and the removable piece at once forced to place and held in its proper position until the cement has become thoroughly hardened. By this means the proper adjustment is insured, and the same precaution should be observed in all of the succeeding similar methods.

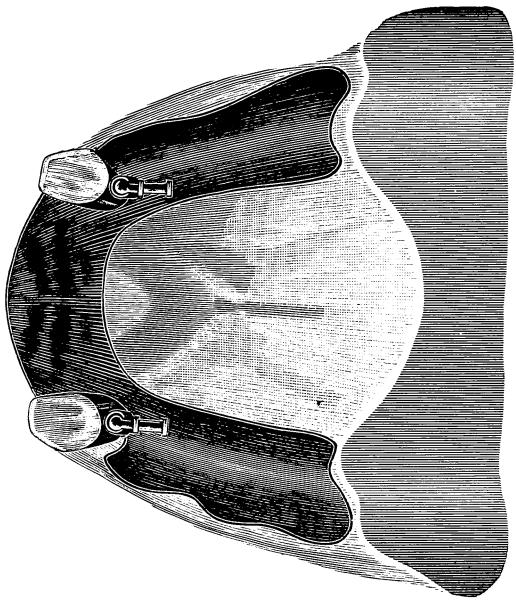


Fig. 396. B.

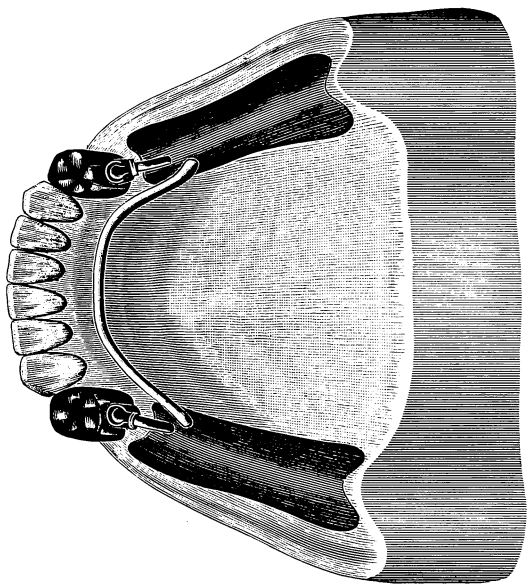


Fig. 396. A.

The Condit Attachment.

Another form of anchorage which is designed to be used in connection with some type of artificial crown exclusively, and which has been more or less extensively employed for a number of years, is manufactured by the Dental Improvement Co. of Mt. Vernon, Ohio, and is known as the Condit Attachment.

This attachment, while made on lines somewhat similar to the preceding one in that the telescopic principle is involved, has a much greater surface contact between the "fixed" and "removable" parts. This allows practically no play and, therefore, makes a perfectly vertical position, and absolute parallelism, essential when more than one attachment is used on a single case.

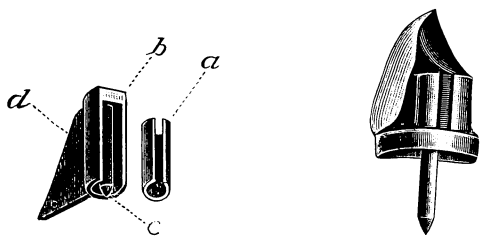


Fig. 397.

While this demands the utmost accuracy in employing the attachment, still the same is true of most methods of anchoring removable appliances, and hence is perhaps not always to be regarded as a particularly objectionable feature.

The Attachment. The attachment, which is illustrated in Fig. 397, consists of a gold clasp tube (a) open at the side and both ends, which is to be soldered to the supporting crown, and a telescoping tube, called the *shield* (b), which is open at one side and at one end. This has a round *pin* (c) with tapering point which passes through the center and is fastened to the closed end, and is also provided with a V-shaped metal projection (d) placed on the side of the telescoping tube (b), opposite the opening, for the purpose of affording attachment to vulcanite, but is not used in metal work. As the pin passes into the tube (a) the latter embraces it with a tension proportionate to its spring, and rotation is in turn prevented by the telescoping tube fitting closely to both sides of the inner tube.

The attachment is machine-made from a solid piece of metal, and the parts are uniform in size, interchangeable, and sufficiently long for any length of "bite." In some cases, however, it may be necessary to

shorten them, but in so doing the end of the pin is made blunt. This would make it difficult to insert it in the tube, hence it must be retapered, and an implement for this purpose is provided, as is also an instrument adapted to cleaning out the attachment after vulcanizing and polishing, both of which are to be used in the engine.

Aside from the possible danger of breaking off this pin, and the amount of space occupied by it, this form of attachment may be found useful.

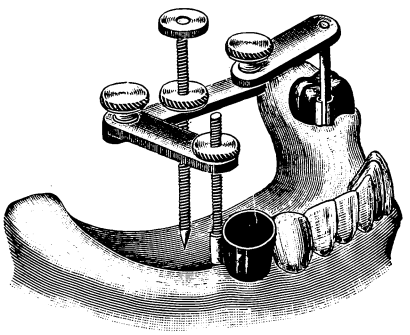


Fig. 398.

Application. The attachment is furnished in iridio-platinum as well as gold, and is, therefore, applicable to either porcelain, gold or vulcanite work. While the adjustment of a single attachment may be made with the eye, in those cases in which two or more are employed on the same piece, it is absolutely necessary that they be placed in a vertical position, and parallel with each other, and for this purpose a very simple paralleling instrument is used.

When the crowns which are to support the "fixed" part of the attachment have been completed, a good model with them in position thereon should be obtained, and the tube part of the fixture then temporarily attached to the crowns with wax, by means of the paralleling instrument, Fig. 398, after which they should be removed and soldered.

Metal Work. In metal work, the base should be swaged and fitted and the impression then taken with it and the supporting crowns in position. The adjustment of the respective parts to their proper position, and their subsequent attachment with solder may then be effected on the model, after which the crowns should be permanently mounted with cement, and the removable

fixture forced to place and allowed to remain until the cement has become thoroughly crystalized, when a combination "bite" and impression may be taken and the case finished in the usual manner.

Vulcanite.

When the case is to be made of vulcanite, the crowns should be permanently mounted with cement as soon as the tubes have been properly attached to them, and the removable parts of the attachment should then be placed in their respective positions on the crowns and the "bite" taken in wax,

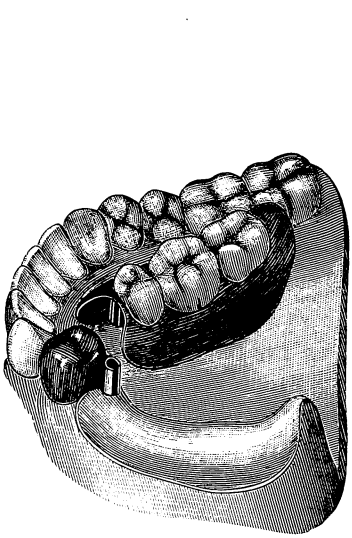


Fig. 399. A.

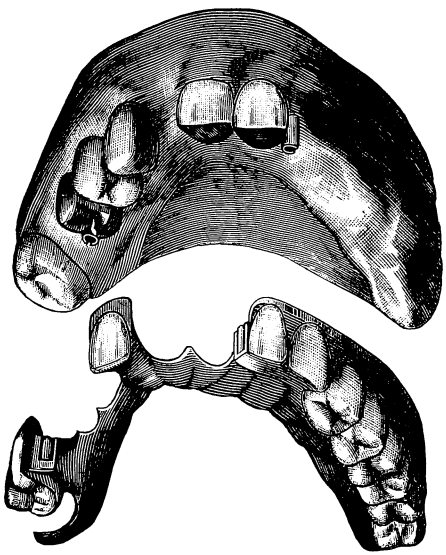


Fig. 399. B.

and the impression in plaster. These parts should come away with the impression upon removal, and it should then be observed that they occupy their proper position therein. A supplemental tube, which is provided, and which will anchor them securely to the model during the process of construction and vulcanization should now be placed in position in each attachment, and the model then obtained, after which the "bite" may be adjusted, and the case finished as usual.

A simple and quite common application where but a single attachment is used is illustrated in Fig. 399-A, while a more extensive case involving the use of two attachments is shown in Fig. 399-B.

The Morgan Attachment.

Another type of attachment which is to be applied in much the same manner as the preceding one, is made by Dr. J. B. Morgan of Davenport, Iowa, and is known as the Morgan "system" of anchorage. While this form of attachment is more simple in its construction, and is apparently much stronger than the former, yet the telescoping parts fit so closely that accurate parallelism in their adjustment is also necessary, and little or

Fig. 400.

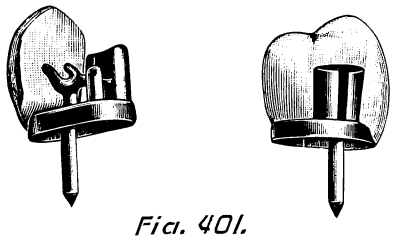


Fig. 401.

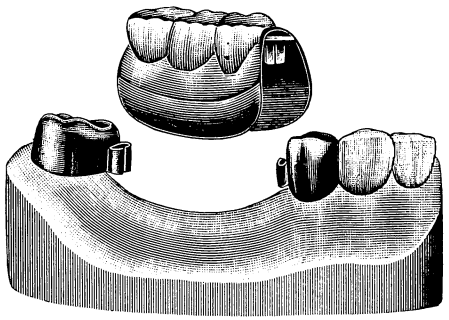


Fig. 402.

no opportunity is afforded for tightening the parts when loosened by friction, or for accommodating subsequent settlement.

Attachment. The attachment consists of a curved and flattened tube, Fig. 400-A, into which a two-armed anchor piece closely telescopes, Fig. 400-B. The curved piece (a) is called the "keeper," and this is to be firmly affixed to the supporting abutment piece. The anchor piece (b), which fits snugly into the "keeper," has a projecting stem which passes between the open ends thereof, and furnishes a means of anchorage for vulcanite, or of opportunity for attachment to a metal base by soldering, and a cap or cover-piece which limits the range of adjustment.

Application.

The parts are made in both gold and iridio-platinum, and hence are applicable to either vulcanite, gold or porcelain work, and to dowel crowns in either gold or porcelain (Fig. 401), as well as the ordinary gold telescope crowns.

As absolute parallelism is demanded, the *modus-operandi* incident to the application of these attachments is practically identical with that described for the preceding type, and a paralleling device called a "jig,"

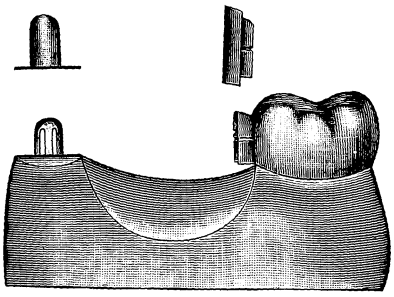


Fig. 403.

and supplemental tubes for securely holding the anchor piece to the model in the construction of vulcanite work, are provided.

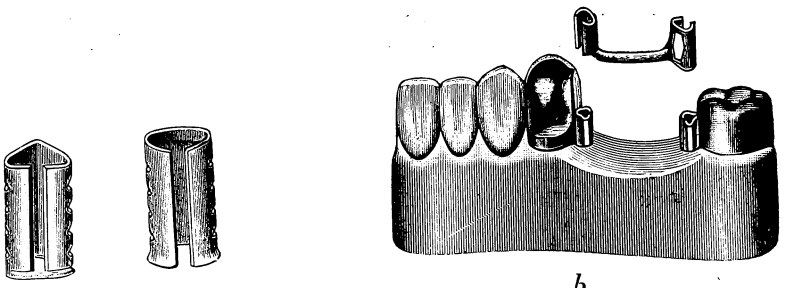
Two cases which will serve to illustrate the typical application of these attachments are shown in Fig. 402.

The Griswold Attachment.

Among the several methods of attachment which have been devised and extensively recommended for their practicability and more or less universal applicability are those introduced and known to the profession as the "Griswold System."

These embrace three different types of anchorage, designated as the "Spring Studs," and "U" Springs, which are shown in Fig. 403, and the "V" Attachment. While the two former have been practically abandoned because of proving entirely inadequate to the demands of removable fixtures, and of being too intricate, the latter may be found more or less useful, though it is doubtful that it possesses any particular advantages over the previously mentioned attachments.

"U" Attachment. This attachment is similar to the Morgan one, and may be employed in much the same manner. It consists of a pair of telescoping "V"-shaped open tubes with corrugated sides (Fig. 404-A), one of which is to be affixed to the abutment piece, and the other to the removable part of the fixture (Fig. 404-B).



a *b*

Fig. 404.

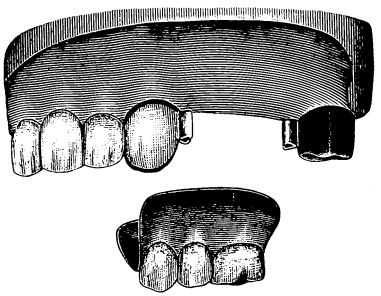


Fig. 405.

Application. These attachments are made of a special alloy which it is claimed will not lose its resiliency when subjected to the degree of heat necessary to fuse 22-K solder. Thus their application is limited to gold or vulcanite work, unless they may be attached to porcelain work after the piece has been baked.

For vulcanite work it is recommended that the removable parts first be united with a wire, as shown in Fig. 404-B, after their proper adjustment has been secured, if possible, and that the attachment of the teeth thereto then be made with vulcanite in the usual manner, while if a gold base or saddle is to be used, the attachment of the parts should be made to it instead of to the wire.

The technique incident to the application is otherwise practically the same as required for the two former methods. Fig. 405 illustrates a typical case.

Kelly's Method.

Another form of anchorage for removable pieces which may possibly have some field of usefulness, has been devised by Dr. J. L. Kelly of St. Paul, Minn. This embraces a pair of short telescoping tubes with one end

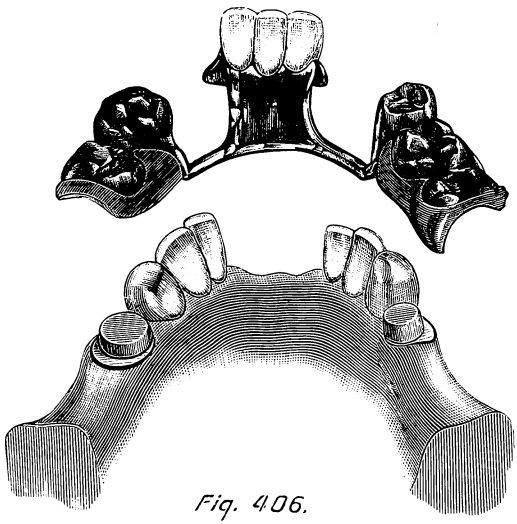


Fig. 406.

closed, which are machine-made, of iridio-platinum, 28 gauge, and in sizes varying to meet the demands of the tooth to which they are to be adjusted.

Application. In the application of this method, the root is prepared as for an ordinary dowel crown with a band, and the usual form of cap is made of 28 gauge platinum and fitted thereto, after which the "bite," and an impression in plaster, is taken with them in position. The caps should then be filled with wax and the model obtained. The edge of the inner or smaller of the telescoping tube should be filed to fit the floor of the cap and so as to sustain a vertical position thereon and this relation made permanent by soldering.

When the caps are thus completed they should be replaced upon the model, and the telescoping part, or larger tube, fitted and adjusted to them. As a means of retaining these in their proper relation to the caps, and to each other, they should now be fitted and soldered to a metal base, or wire, and the case then completed in the usual manner. Fig. 406 shows the application to a typical case.

The size of these telescoping tubes, and the alloy of which they are made, doubtless afford some degree of strength, but the space occupied by them is obtained at the expense of the crown of the natural tooth used to support them, and of the adjustment of the artificial teeth to be supplied, and these features, together with the fact that a vertical position and absolute parallelism must prevail; that they must become loosened in time as a result of friction, and that no opportunity for subsequent settlement is afforded, makes the method one of limited practicability.

a *Fig. 407.* *b*

Dunn's Method.

A very simple method of obtaining anchorage for "removable bridges" or partial dentures which may sometimes be found useful is advocated by Dr. J. E. Dunn of Chicago.

In this method the anchorage of the piece is obtained by constructing a gold or porcelain crown with a lingual shoulder, formed by an extension of the cusps at this point, as illustrated in Fig. 407, and by then making the fixture so that it will spring to place over this projection, and adapt itself snugly to the body of the crown.

Where the principle may be applied to supplying the lower posterior teeth, and where a stiff springy clasp metal wire such as has been previously recommended for lower cases may be used; or where, in similarly favorable cases, a vulcanite base may be made thin and springy, this method offers a very simple and practical means of anchorage.

Similar Methods

A considerable number of methods of similar character have been devised, and while some of them may possibly have a limited range of application, and may still be used to an extent, many are already obsolete,

and others are not included for the reason that they are not regarded as possessing such special merit as to warrant separate consideration.

The Principle of United Piers.

The application of bridgework in a mouth, where the remaining natural teeth are more or less loosened, is always a problem requiring the most careful study. It is evident that if a denture is to be supported by piers, whether permanently attached, or removable, more than normal

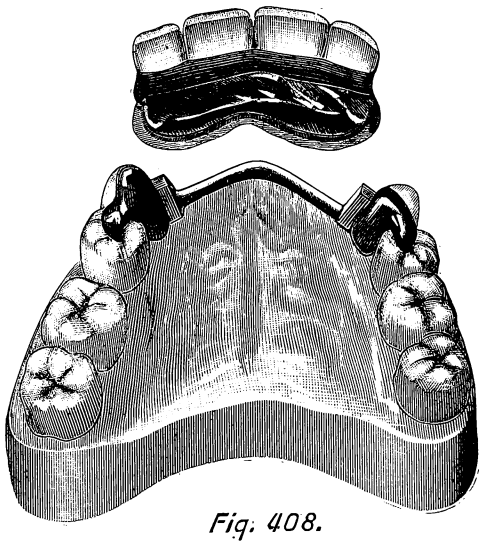


Fig. 408.

stress must be resisted by these piers, and if they are already weakened, either by disease or the loss of alveolar support through recession of tissue, the utilization of them as posts becomes a hazardous procedure. It is evident, then, that if something more than a temporary result is to be attained, the denture must be constructed with especial reference to the looseness of the piers.

It is an important fact, proven by repeated experience at the hands of those who treat pyorrheal condition that the binding together of two loose teeth often more than doubles the stability of both. This is partly due to the prevention of movement in at least one or two directions, with

the result that the supporting alveolar tissues are afforded opportunity of reattaching to the roots. Applying this clinical fact to bridgework a means is at once afforded of rending even quite loose piers useful.

Bryant's Methods.

Dr. Emory A. Bryant has recommended in these cases the use of a combination fixture a part of which is permanent, while the main portion may be removable. For example, a case might present where the molars

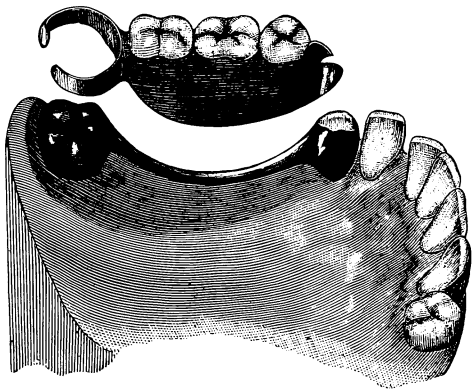


Fig. 409.

and second bicuspids, as well as two or more of the incisors may be absent from the upper arch. Examination shows that the remaining first bicuspids are somewhat loose. The natural crowns of these are removed, the pulps extirpated and abutment crowns made for them. Between these bicuspid abutments a stout iridio-platinum bar is formed to lie snugly against the gum tissue, and to this bar are fastened the substitutes for the missing centrals. This, attached to the bicuspid abutment produces a permanent bridge for the anterior part of the mouth. To the abutment crowns, are fitted the Bryant clasps already described, and these are attached to the removable denture which is to bear the molars and second bicuspids.

But even where no teeth are missing in the incisive region, it is often wise to thus attach the piers to one another.

Fossume's Method.

Dr. F. L. Fossume has constructed a number of ingenious dentures in which the principle of uniting the piers is followed in a somewhat different manner. The advantages are reinforcement of loose piers, and greater stability of the piece, all lateral motion being avoided. It must not be understood that this style of fixture is applicable *only* to loose piers; on the contrary, the more stable the piers the more rigid will be the denture in use.

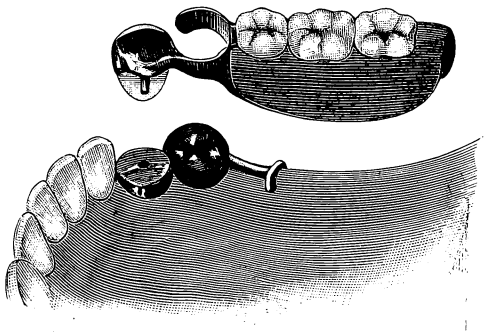


Fig. 410.

Application. The application and variations of Dr. Fossume's appliances may best be described by illustrating a few typical pieces. Fig. 408 gives views of a model, on which is seen the apparatus which unites the piers, while above it is the removable denture. In this case the pulps were removed from the two cuspids and both bicuspids, canals properly treated, and iridio-platinum posts accurately fitted to all the canals. Pure gold plate, 36 gauge, was burnished over the palatal surfaces of the cuspids, and the already prepared posts pressed through the gold into the canals, the ends projecting. Similarly, gold was burnished into the cavities in the bicuspids through which the pulps had been removed, and the posts pressed through. The posts were tacked with hard wax to the gold matrices and each removed, invested and reinforced with high-grade solder. They were then restored to position in the mouth, each properly shaped and polished, withdrawn with an impression, models run, and for each side the cuspid

and bicuspid parts united with solder. This produced practically a cast filling for each side, having posts that entered the canals of cuspids and bicuspids. These were again placed in position in the mouth and a new impression taken. On the resulting cast a heavy connecting bar of iridio-platinum square wire, was fitted and united to the abutment pieces as shown in Fig. 408. This was once more placed in the mouth and a new impression taken, and from this final cast was swaged a platinum saddle which accurately fitted over the bar and against the gum tissue.

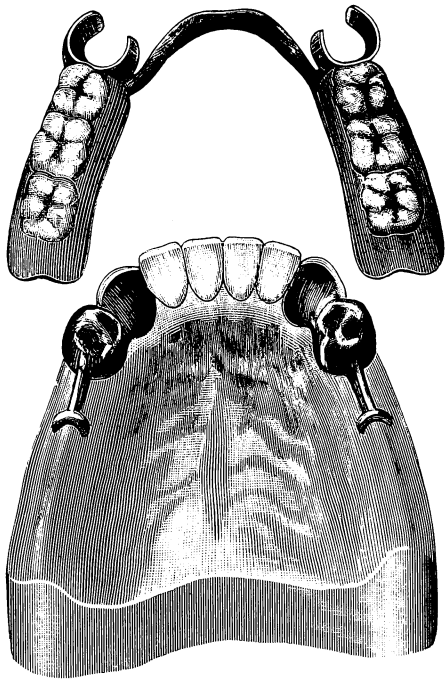


Fig. 411.

At each end a small clasp of gold was soldered to hug the lingual surface of the cuspids; these permit tightening of the denture. Fig. 409 shows the application in the posterior part of the mouth.

Extension Bridges.

Dr. Fossume's success with the bar uniting two piers has led him to make a variation which is applicable where there is an abutment only at one end. Fig. 410 is a case like Fig. 409, except that there is no posterior pier. For this case a shell crown was constructed for the bicuspid, and to this was soldered a short, square bar, at the extremity of which a cross bar was soldered forming a T. As before, the saddle of platinum was swaged to conform to the ridge and to engage the bar. A stout clasp to encircle the gold crown was soldered to the saddle, and also carries a porcelain facing, which is made on the tube and pin plan previously described. Fig. 411 shows the application where the posterior teeth are missing from both sides. The construction is the same as in the last case, except that here Richmond crowns were made for the cuspids and united with the bicuspid crowns by soldering. In all of Dr. Fossume's cases the teeth are attached with rubber, but gold or porcelain may be utilized as the operator may elect.

The Care of Dental Bridgework.

The duties which devolve upon the operator who constructs dental bridgework and who is interested in the success of his efforts, and in the welfare of his patients, do not cease upon the completion and insertion of the work, but also demand that he impart to the patient such instructions as to the care of the same as will promote the most favorable hygienic conditions of the mouth which is possible under the circumstances.

Those who are compelled to wear "Removable" bridgework, and particularly large pieces, should be advised to remove and carefully but thoroughly cleanse the fixture before each meal, and afterward, also, if possible, over a basin partially filled with tepid water, and with a suitable brush and a good soap; and that it is usually best to remove the piece upon retiring and place it in a glass of water, or preferably, in some good properly diluted antiseptic solution.

The former is essential as a means of removing all accumulated and decomposing secretions, and should be observed more particularly before meals than afterward, in order that the mouth may be free from such deleterious influences during the meal. Removal at night is equally important as a means of keeping the fixture itself in a thoroughly hygienic condition, and of allowing the tissues of the mouth to rest, and to assume their normal state, thereby relieving the capillary congestion and promoting the health of the parts.

The wearers of "Fixed" bridgework—which is at best more or less unhygienic—should always be advised of this fact, and so forcibly impressed with the necessity for scrupulous care as to be made aware of its importance. They should furthermore be fully instructed as to exactly how such care may properly be given. For the reasons mentioned a thorough cleansing of the mouth, and of all surfaces of the work upon rising every morning, and previous to each meal whenever possible, should be recommended, and the proper style of brush and antiseptic solution should be prescribed.

While almost any good mouth preparation will answer the purpose, yet, any agent, however pleasant or potent, will fail to afford the desired results unless the patient has been made familiar with the requirements, and is then faithful in observing them—and these fundamental prerequisites will always depend largely upon the dentist himself.

Art in Model Making.

By Dr. Alfred P. Rogers, Fall River, Mass.

Read before the American Society of Orthodontists, Chicago, 1905.

I believe my first duty this afternoon is to ask your indulgence, because under the title of my paper I feel that I must present many details with which you are already familiar. I am prompted thus by the fact that I wish to give my paper as wide a range of usefulness as possible. The profession of dentistry is in need of many of these details. Therefore, my wish is to show, not only how model making lies at the very root of all our efforts in orthodontia, but to emphasize the fact that the general practitioner should be conversant with these methods, if for no other reason than that he sometimes meets with cases of universal interest, which should be preserved for the profession, and unless he is proficient in model making, his efforts stand only as a sad commentary on one of the deficiencies of the dental profession.

We believe in harmony and balance. They are very essential points with all of us. We have not despised art in our work, for we have recognized that harmony and beauty are synonymous. It is this recognition that causes me to say most earnestly that we should tolerate nothing in our work that is disproportionate or ugly.

Those of you who have given the least attention to the literature of dentistry, or who have observed, ever so slightly, the methods in vogue, must have been impressed with the almost utter lack of art in relation to model making. Indeed, one idea prevalent with the dental profession

is that the model has little value as a record; that it may be carelessly made with little or no thought of perfection or minuteness of detail. Dentists seldom seek, and almost never receive, as far as I can make out, right training along these lines. It is our regret that our museums are filled with an array of unattractive and ugly models intended to be preserved as records of some of the most unique and interesting specimens, when they should be filled with models of artistic beauty and worth.

I wish to add that it is undoubtedly true that we must learn to see before we can understand the mouth conditions to fully appreciate them. One never fully sees a landscape until he has learned to draw one, nor does he truly know the flowers until he has learned to represent them. May we expect, then, that a man may see and understand the mouth with its defects and requirements before he has learned to accurately represent it? We cannot expect to do our highest work without the highest and best facilities for study and discernment. Yet some would have us use faulty and uncertain methods in this work, and the worst of it all is that such methods have long brought discredit upon work which might have turned out to be of permanent value. But we must not condemn, but rather admonish, those who so practice and advise. Let us hope that in the future there will be seen fewer of these grotesque and distorted models held up for the world to see. Would that they could but recognize that that upon which our labor has been spent, and is often so apparent in the product, has one of the deepest claims for their admiration; that the making of a beautiful model has a distinct value in itself, which claims for it recognition and encouragement.

Value of Perfect Models.

The model which I have in mind, and about which I wish to speak to you this afternoon, must be an unchangeable record of fact. Anatomically, it must be a perfect representation of mouth conditions; all of the teeth with their delicately curved surfaces, their incline planes, grooves, and root inclinations; the gum tissues with their stipples, the delicate muscles, and muscular attachments, all must be present. In proportion as these are absent, the model becomes worthless as a scientific record or work of art. The correct model must not only have these essential points, but its artistic proportions must be tastefully executed and harmonious throughout. Every angle in its proper place, capital and base in exact proportion to its anatomical column. Its surfaces as smooth and clean as polished marble.

One of the greatest and most comprehensive steps in the diagnosis of malocclusion is Dr. Angle's classification. Now the best aid to correct diagnosis is a perfectly made model.

My main purpose, then, is to determine with your help what art in model making practically includes, and how we are to obtain the most accurate and artistic results. I shall make no effort to reach its compass, but shall be satisfied to bring before you a few thoughts, leaving much for your discussion.

The Impression. The first and most important step in our work is the impression. Accuracy is the keynote here, as in all other operations in orthodontia. Without accurate, painstaking methods a perfect impression is impossible; with them the work becomes a pleasure. Fig. 1 illustrates an accurate impression of the lower arch.

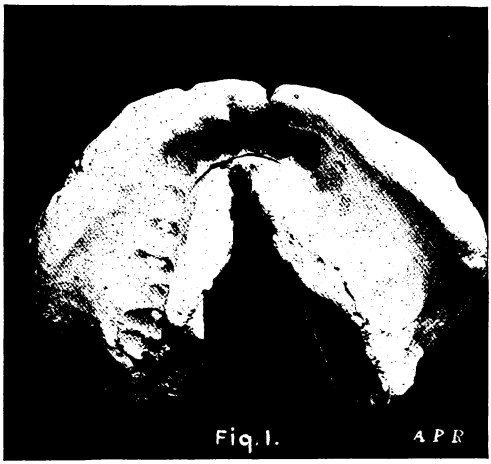
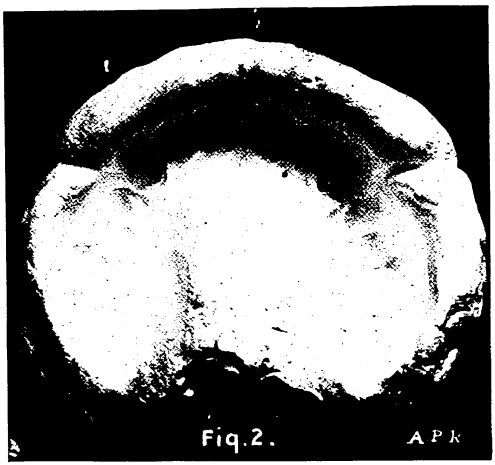


Fig. 2 illustrates an accurate impression of the upper arch. Notice here the full deep impression of the buccal and labial spaces. This is one of the great essentials to an accurate impression for model making. Our first care in securing a good impression is in regard to the patient's mouth. All deposits and foreign particles must be removed, and the teeth thoroughly cleansed. A suitable tray is then selected, and bent to fit the mouth accurately, leaving sufficient space in every direction for a good thickness of plaster. With the patient's mouth in readiness, and the tray in a convenient position for filling, we proceed to mix the plaster, using distilled water about 70°. The plaster which you have found by experience best suited for the work, is then slowly sifted into the water with little or no stirring. When the last particle has disappeared below the surface of the water, the surplus is poured off and the plaster is ready for the impression. The grooves of the tray are then filled. Should the impression

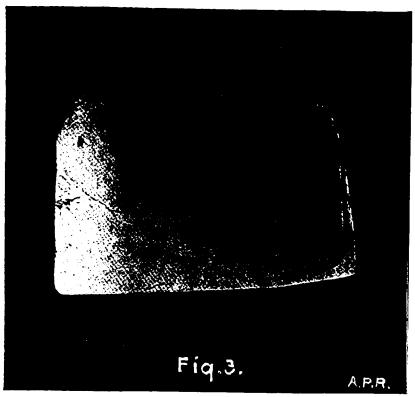
be an upper one, the roof of the tray receives no plaster at all. Placing the tray where it may be readily reached, we proceed to fill the buccal and labial spaces, using a bone spatula to insure ease of application and cleanliness. When the plaster has been carefully worked under the cheeks and lips, and all the air expelled, we place the tray firmly in position. Sufficient time is then given for the plaster to harden before the tray is removed. At this stage many fail, being tempted to remove the impression too soon.

Every particle of softened and broken plaster is now removed with



the aid of pliers and rolls of cotton. Grooves are then cut in the cuspid region, and the plaster carefully pried from its position, using care to apply the force in such direction that the impression of the inter-dental spaces will not be broken from the main portions. As the pieces are removed, they are set in order upon a clean blotter bearing the patient's name. When sufficiently dry the pieces are accurately placed in position, not, however, until the edges have been carefully dusted with a camel's-hair brush. The small pieces are first united to the larger by the aid of a celluloid cement, then the whole impression is assembled. In spite of the utmost care, we sometimes find it necessary to retouch the impression. A porous spot, an air bubble, or it may be the line of fracture is too apparent. These slight defects are better corrected in the impression, and, if nicely done, not only improve the model, but render subsequent carving unnecessary. It is fine work, and must be done with care and skill, much the same as a negative would be treated. In fact, the camel's-

hair pencil used by the photographer is admirably suited for this work. The pencil is thoroughly wet in clean water, and upon its point a small particle of plaster is carried to the marred surface, with which it is carefully painted; the water sinking into the dry surface of the impression carries the plaster with it. When this work is done as it should be the surface of the impression is not changed in the slightest, but the defects are nicely obliterated. It must not be supposed that this method may be used for building up impressions or supplying lost pieces; its mission is abused when it is so used.



Varnishing. Much care is needed in the next step of varnishing the impression, that the fine lines may not be destroyed by using too thick a varnish or by applying too many coats. It is better to have the varnish quite thin and apply an extra coat if needed. It is difficult to make clear just how heavy the shellac and sandarac varnish should be.

Pouring the Impression. When the shellac and sandarac varnish have sufficiently hardened we prepare for the model, by first thoroughly soaking the impression in water. This is done to insure an easy separation of the impression from the model, as it prevents the infiltration of water, carrying with it minute particles of plaster. It has been my observation that we procure better results when the plaster is allowed to settle in the water with little or no stirring, and that done with the edge of a knife. Thus the crystallization is disturbed but little and air bubbles are eliminated. The plaster is now carefully worked into the tooth impressions by means of a camel's-hair brush, beginning with the molar on one side and

following around until we reach the opposite side. The remainder of the impression is then quickly filled with plaster, and worked into a cone-shaped mass, inverted and placed squarely and firmly upon a clean glass slab. If care is used here, much labor is saved, because you may calculate quite nearly the height of the capital or base. When sufficiently hard, and before removing the impression, we trim neatly, as shown in Fig. 3.

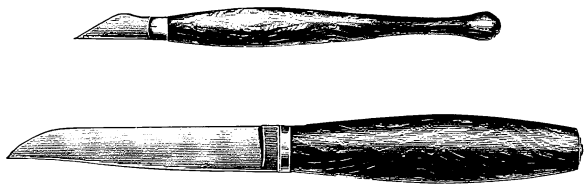


Fig.4.

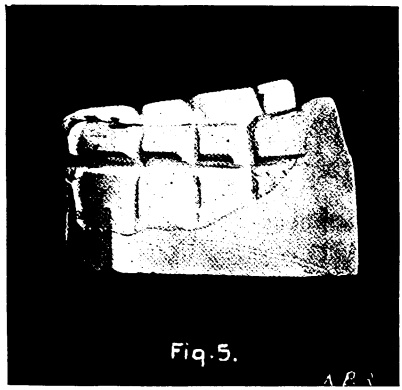


Fig.5.

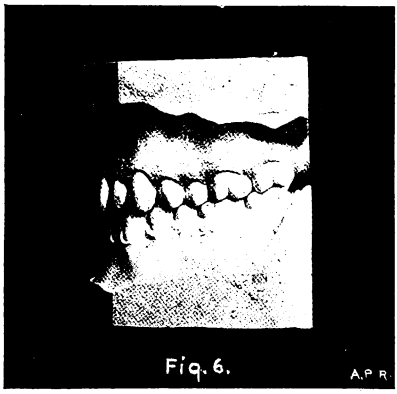
By following this method the delicate surfaces of the model are protected during the roughest part of the trimming. In this illustration we can notice the thickness of the capital already shown.

Fig. 4 illustrates the instruments used in trimming. The smaller knife is used for cutting grooves and prying away the sections.

Following this trimming the grooves are carefully cut until the coloring matter is reached. (Fig. 5.) In prying the sections away the operator must bear in mind any irregularities, and pry in the direction least apt to cause fracture. When the work has been carried on thus far carefully and neatly, we will be greeted with a beautiful reproduction of the anatomical portion. Care must now be taken not to mar its beautiful surface, upon which little or no trimming is necessary.

Fig. 6 shows the appearance of the model directly after the removal of the impression; no trimming or retouching has been done to its anatomical surfaces beyond the removal of the small bits of the impression from the inter-dental spaces.

With the anatomical portion of the model completed at this stage we next turn our attention to the trimming of the capital and base. These must be trimmed to give aesthetic beauty to the model. Now these artistic portions to my mind, must always conform to definite rules,



not always, perhaps, to the simple rules of plain perspective, but in every case they must conform to rules made imperative by the model itself.

Rules for Trimming Models.

Fig. 7 illustrates the general outline of the capital and base. To the left of the picture the capital is shown, to the right the base. It will be noticed that the base is trimmed identical with the capital, with the exception of the curve GAB which is used instead of the angle of the capital. In trimming these artistic portions the surface X is trimmed parallel to the grinding surfaces of the molars and bicuspids. While doing this we must consider the height of the capital or base, and trim down until we have placed them in right proportion to the anatomical part. This is measured on the section directly above the central incisor, and is usually about one-third or one-quarter the distance between the cutting edges of the central incisors to the extreme height of the labial space. (Fig. 11.)

The surface represented by ED is next trimmed; this must be parallel to the right and left tuberosity. This surface must be at right angles to the surface X, as indeed are all the surfaces that require trimming. BC and FG are trimmed parallel to the buccal surfaces of

the molars and bicuspids. The angles G and B directly over the cuspid teeth and the angle A directly over the frenum. The short surfaces CD and EF are trimmed at right angles to lines drawn from the angles G and B and are about one-quarter the length of the lines AB and AG.

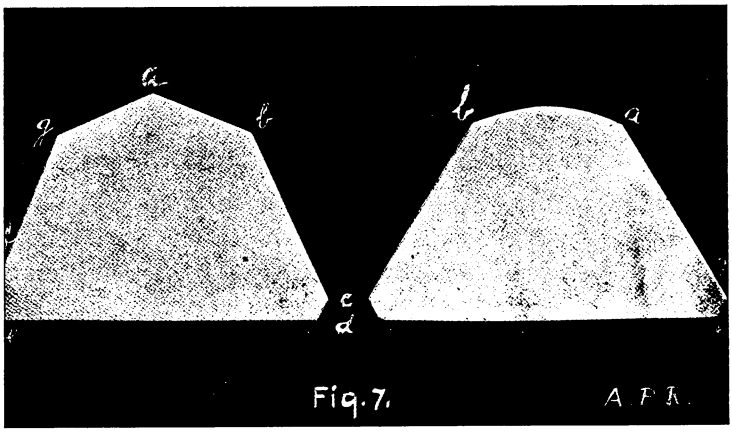


Fig. 7. A. F. R.

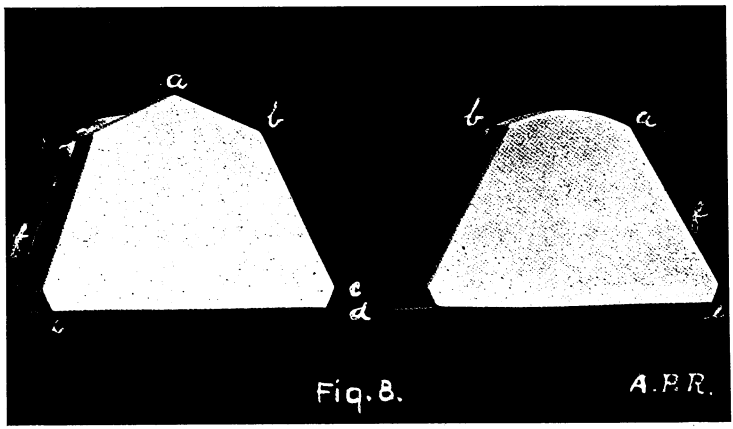
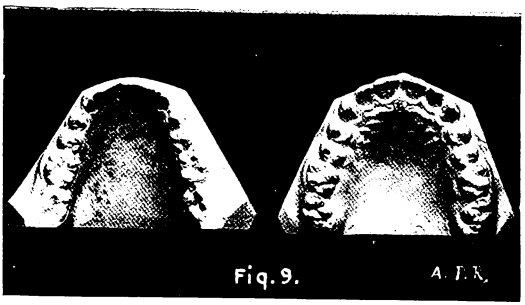


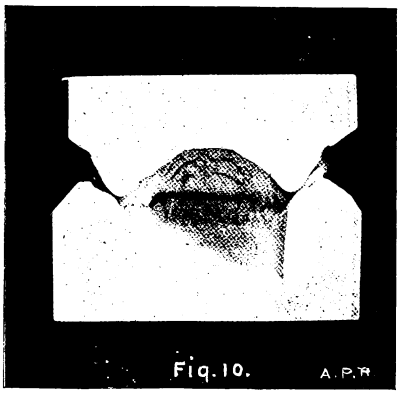
Fig. 8. A. F. R.

Fig. 8 shows the surface FG at right angles to the surface X. Fig. 9 shows the occlusal surfaces of the model. Fig. 10 represents the back view, showing clearly the lingual occlusion.

The rough trimming may be done with a very sharp knife, such as is shown in Fig. 4. When the rough trimming has been completed (Fig. 6), the model is gone over with a camel's-hair pencil and soft plaster, care-

fully filling all the air spaces and porous spots on its surface. The model is placed away until it becomes thoroughly dried, when it is ready for the final finish. To accomplish the most beautiful results, a fine, broad, flat jeweler's file is used with a rotary motion. When all surfaces are well finished, a slight bevel is placed around the entire edge.



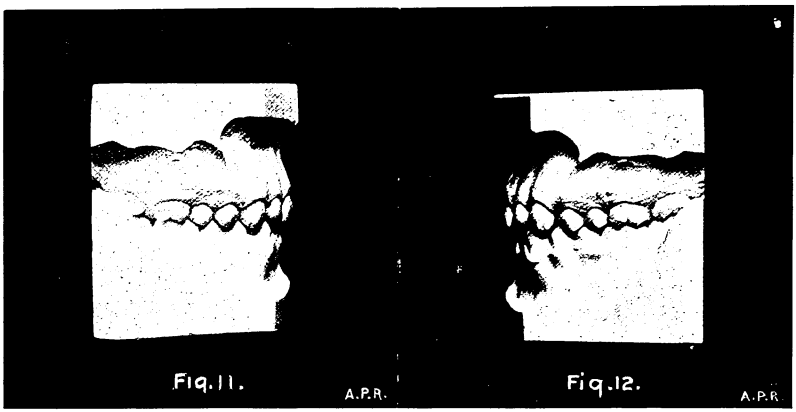


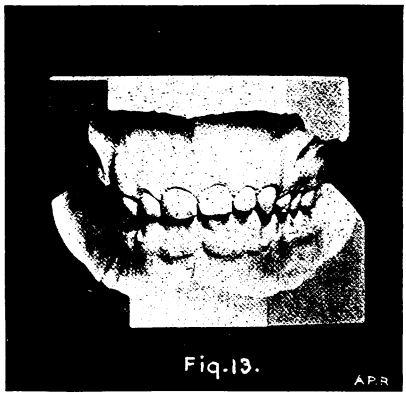
Figs. 11, 12 and 13 represent different views of a finished model. Now if our work has been done with care and skill the result will be a beautiful and harmonious model, the reproduction will be exact and a thorough study of the case made possible. I wish at this point to emphasize that preparation is the foundation of all our success in orthodontia, because the habit of accuracy is here formed, and it is powerful in averting annoyances from early errors.

In this short paper I have by no means presented all there is regarding the subject, having left points regarding the repairing and preservation of models, as well as some details regarding the anatomical portion, but in doing so I have tried to impress the fact upon you, that when a good

impression is secured and properly treated the trimming of the anatomical portion of the model becomes unnecessary.

Doubtless many of you have valuable ideas which you have tried and proven. These we want brought out in the discussion. In this way alone





may a paper be made complete. In this connection I wish to acknowledge my indebtedness to Dr. E. H. Angle, Dr. J. Lowe Young, and others among you, for the use of knowledge learned in reading and conversation.

Discussion.

Dr. H. A. Pullen, Buffalo, N. Y.

It is with great pleasure that I have listened to such an extremely interesting and scientifically accurate paper. Those of us who have been connected with the American Society of Orthodontists

since its inception are especially interested in the paper because it shows to us that the methods used in model making have advanced considerably even since the first class of specialists received their instruction in this work at the Angle School, and also we feel that much of this advancement has been due to the ardent work of the members of this society.

The trimming of the capital and base of the models according to certain definite geometrical lines is not only the most artistic and best proportioned conformation of otherwise ungainly reproduction, but serves the very practical purpose of a standard for uniformity which enables the busy orthodontist to more quickly and consecutively follow out the definite rules for its treatment, than by the old and less accurate methods of model trimming.

There is only one thing that perhaps might be added to a paper which is so complete, and that is in connection with the artistic repairing of models which are defective through occasional careless manipulation. Cusps will sometimes be broken off, and there is a method of replacing them by the use of the knife and camel's-hair brush which I described in the September ITEMS OF INTEREST in 1900. I only mention it because of the necessity which arises for repair of casts which have been accidentally broken either in separating or by careless handling.

I wish especially to commend the class of paper which Dr. Rogers has presented to us for its accurate and scientifically concise descriptions of methods for the production of the artistic models which have been thrown upon the screen.

Dr. J. Lowe Young, New York.

I have enjoyed this interesting paper, and while I have few if any criticisms to offer, I wish to go into detail a little more than the writer has. To the members of this society, at least a majority of the members, I believe that it is perfectly clear; but this paper will not stop with the American Society of Orthodontists, but will go into print and stay there a long time.

I want to emphasize a point that Dr. Rogers made. That is, that we cannot have any definite measurement as to the length of the lines in the anterior part of the model which represents the artistic part. To make that clear, we will divide the model into the anatomical and artistic parts. The anatomical part should not be touched at all after removing the impression. That should be left perfectly clear. It should not even be touched with the fingers if possible. The artistic part is that which we work on and plane to certain definite lines. Now, as Dr. Rogers said, the length of these lines can only be determined by the anatomical part of

the model. Certain models need a wider base and a wider capital than others, and there comes in the question of balance. We must have the anatomical and the artistic parts of our model in harmony or they will not look right, no matter how perfect our angles may be.

The point he brought out, which I do not think has ever been written on before, of placing the plaster in the buccal and labial portions of the mouth with the spatula before inserting the tray, I think was first tried on my own mouth when Dr. Rogers was taking an impression for me. I have a pretty good lip pressure, and he thought it would be a good idea to force a lot of plaster in there to keep it out of the way, so he packed a lot in. I find this very valuable in lower impressions, but very rarely use it in the upper; but I believe he uses it all the time, and he certainly gets good impressions, as his slides have shown here to-day.

In describing the preparation of the impression prior to running the model he again omits detail. It is clear to us, but the general practitioner will not know whether to give one coat of shellac or two or a dozen. I think he ought to be more particular about that, and tell us how many coats of shellac he gives, and also the exact weight of shellac he puts to a certain number of ounces of alcohol. You can bring up the argument that the shellac solution is not staple, owing to the alcohol evaporating. That is all very good, but if you tell a man what is the right proportion, then if he is possessed of good judgment he will know when his shellac gets so thick that he ought to add alcohol.

In removing the impression from the model we should have a definite starting point if the best results are to be attained, and we should so hold the case that our fingers will not come in contact with the anatomical part. To do this, begin on the right side molar region if an upper, and the left side molar region if a lower.

He says the plane a, x, i, s, which is, we will say, the bottom of the lower model, should be parallel to the occluding surfaces of the bicuspids and molars. Now, I do not quite agree with that. I think that the plane a, x, i, s should be so that when the model is sitting level on a piece of glass or any surface even with the eye, that you have the teeth about in the position as you see them in the mouth, whether they are parallel or not. Then trim the rest of your model to correspond with that, along the lines that Dr. Rogers has given. I think you will have better appearing models if the plane a, x, i, s and the top part of the upper model are parallel.

Dr. C. A. Hawley, Cleveland, Ohio.

There is but one point in the making of models that I would like to discuss. The most important part of a model is the anatomical part, and upon its accuracy and smoothness depends the value of the

model. The greatest difficulty that I have had myself and have seen others have, is in the separation of the impression from the model. If it sticks too close, the model is almost sure to be cut and marred. It is quite difficult to know just how much varnish to use. If the varnish is thick enough so that when the impression is poured dry it will prevent the water of the plaster from going through into the impression, it is too thick and will destroy the fine lines of the model. Any plaster that is carried through the varnish with the water will make the impression stick closely to the model; but if the impression just before pouring is thoroughly soaked with water so that it is completely filled, and then the fresh plaster put in as the essayist has described, with a camel's-hair brush, there will be no leakage of the fresh plaster into the impression, and the separation is made much more easily and smoothly. Where wet plaster is poured into a dry impression there is almost always a firm adherence to the model.

Dr. F. M. Casto, Cleveland, Ohio.

The paper and the discussion of it have been very interesting and instructive to me. Perhaps nothing attracts the orthodontist's eye more than a case filled with beautiful models, made from accurate plaster impressions, producing a fac-simile of the teeth and anatomical parts associated therewith and having the bases skilfully carved.

I have spent a great deal of time working on models endeavoring to have them present a respectable appearance, and perhaps after I have satisfied myself upon the results obtained and cast my eyes admiringly upon the beautiful clean white surfaces, some fellow comes along and rubs his fingers over the surfaces, or in handling them yourself they soon become more or less soiled. What can we do about that? You can not hermetically seal them in cases so as to keep them clean. I would like to know of some method of treating models that would not destroy nor obliterate the fine lines and markings, perhaps some coating applied to the surfaces, which would allow of a reasonable amount of handling without ruining the models. I have used or tried a great many methods which have been suggested to me from time to time, but have found none satisfactory. I therefore appeal to Dr. Rogers, or any other member of the society to give us something that will protect them without materially changing their appearance. In his technique of taking an impression the essayist speaks of placing plaster with the spatula under the upper lip and on the buccal sides of the lower arch before inserting the tray. Now, if he will go a little further and put some plaster over the tuberosity and between the cheek and upper second or third molars, whichever the case may be, a good, accurate impression of that part of the mouth will be assured. It has often been difficult for me to get that

part satisfactorily because when the mouth is opened wide enough to allow of the insertion of the tray and plaster the muscles are drawn so tight against the tuberosity and second and third molars that the plaster will not be forced well up over them.

Dr. E. Ballard Lodge, Cleveland, Ohio.

In reference to this matter of the treatment of the impression before pouring the model, I would like to make a suggestion which perhaps will be of some value, and yet perhaps not new. Dr. George Wilson, of Cleveland, than whom it is doubtful if there is a better authority on prosthetic dentistry, makes use first of shellac and then of sandarac varnishes, and in the proportion of three drachms of shellac to four ounces of alcohol for the shellac varnish and three drachms of sandarac and four of alcohol for the sandarac solution. He allows the impression to dry thoroughly and then applies two or three coats of this shellac varnish to fill up the pores of the plaster of Paris. After this is dry he goes over it with one or more coats of the sandarac, which gives the model when poured a very beautiful and smooth surface.

Dr. F. S. McKay, St. Louis, Mo.

I was pleased with the treatment that Dr. Rogers gives the impression before it is even varnished. I take it he fills in the little imperfections as much as he can with the brush and soft plaster. I hoped he was going to tell us more in detail, as Dr. Young says, about the treatment of each surface of the model as he goes along.

As I understand it, he prepares the base first, and from that he gets the surfaces, one by one, at right angles to it. My method has been to prepare one surface at a time, and not try to trim the rest of the model to that surface. He did not speak as though he made any use of the plaster plane that Dr. Angle has recently perfected for us and put on the market, and if he has not, I want to tell him he has missed one of the most valuable instruments that has ever been given to us. I know, if you see it, you will find it surpasses anything else, and just to illustrate the surface it will leave on the model, I brought one or two of my own here to pass around among you. I do not understand his use of the file, and I wish, when he closes the discussion, he would enlighten us more on that point, just how he uses it, and what sort of a surface it leaves.

Dr. D. Willard Flint, Pittsburgh, Pa.

The essayist in speaking about the mixing of plaster said he stirred it a little bit. I think that we can leave out the word "little" and make it none whatever, and we would get better results. If you remember the reading of Dr. Lewis's paper at St. Louis, he made the plaster of Paris like rubber and drew it out in long strips, and said that we could get our best results by just letting the plaster of Paris absorb as much water as it will absorb.

Dr. William J. Brady, Iowa City, Iowa.

There is another feature of model making that has not been touched upon in this paper and that is of value to us. It is not only necessary to make a model that is a correct anatomical record, and satisfactory to the esthetic sense by being pleasing to the eye, but it is also important that a model be trimmed correctly to aid in diagnostic purposes.

There is a universal tendency for the eye to be influenced in its judgment of lines according to the way those lines run and are related to other lines. This fact is observed everywhere, and all artists know of these illusions, as they are called. The architects of tall buildings remember this peculiarity, and when they place columns along a portico or facade certain of the columns are made to lean in at the top to make them appear perfectly true; they are purposely misplaced in order to give the appearance of correctness. We have the same thing to deal with. When we examine a model and try to determine what is wrong with it we are influenced in our estimate of the imperfection of that dental arch by the way the model is trimmed.

There is a certain line which is a very valuable one in this connection to aid in trimming the model, and that is the ridge found in the upper along or over the median suture. Usually the suture between the superior maxillaries is found in the median line or very close to it, and we trim our upper models to correspond to this and leave the same amount of plaster on each side of this line we have a much more accurate cast before us to make our diagnosis from. We cannot give a correct judgment as to what is wrong in a dental arch with an ill-trimmed model, and every aid should be used that will make our work easier or more exact.

Dr. A. P. Rogers, Fall River, Mass.

In closing the discussion I wish to thank you for the keen interest you have shown and the kindly way in which you have carried on the discussion. Those who have criticised have done so justly, and those who have offered new ideas have added much to the value of the paper. For the benefit of readers who may be in doubt as to how many coats of varnish to use on the impressions, I will say that two of shellac and one of sandarac are usually enough when used so thin that the gloss does not appear until the last coat is applied. Regarding the use of the file I would like to impress upon you that one great advantage is that no matter how hard the plaster may become the beautiful surface may be easily attained. The file, of course, must be broad, flat, and very fine. It must be held firmly and squarely on the surface of the model and used with a slow and even rotary motion. The resulting surface is most beautifully smooth and hard and when produced by skilful hands is free from all imperfections.

ORTHODONTIA

The Ankylosis of Living Teeth.

With a Report of Successful Treatment of One Case.

By Rodrigues Ottolengui, M.D.S., New York.

Read before the American Society of Orthodontists, Chicago, 1905.

In presenting this paper, I desire to say in advance that I am at the very beginning of the study of the subject. The views advanced therefore must not be taken as final, but rather as hypotheses, upon which I shall hope to attract the serious research of work of investigators.

It might be asked, why I have the temerity to present opinions, at the same time reserving the right to change them; the answer is, that I appear to have stumbled upon a subject of vast import, the real investigation of which will lead to untold advantages to both orthodontist and dentist. It is evident that the solution can be more rapidly reached through the combined work of many minds. With this apology for a paper that will appear but fragmentary, I approach the important topic of the ankylosis of living teeth.

The Ankylosis of Dead Teeth.

First, however, let us consider the ankylosis of dead teeth, for thus we may better comprehend the phenomena which occur. We are all more or less familiar with the so-called implantation of teeth. The term has been used to cover a variety of operations; the mode of fixation however, so far as has been learned, is the same in all cases. The extreme operation is the drilling of a socket, and placing therein a tooth from another mouth. If aseptically carried through in a healthy subject, and in a locality where the tooth may be entirely surrounded by a bony socket, fixation usually occurs in about twelve weeks. A marked characteristic of this union, which has attracted the attention of all who have seen such cases, is the peculiar sound emitted when the tooth is tapped gently with a steel instrument. I cannot better explain the difference between this and normal union than to say that the sound from the living tooth would remind one of tapping upon a plate made of wood, while the implanted tooth gives off a sound like the tapping on a plate of china. This is a diagnostic sign, of great value, as it is always reliable.

Another form of implantation, the opposite extreme, is where a natural tooth is dislodged traumatically, and is replaced within its original socket without alteration either of the root or the socket. Some have contended that reunion, and continued life of the pericemental membrane is possible in such cases. There is, however, no reliable history of such

a fortuitous result, and it would seem to be physiologically impossible. The pericementum cannot live without a blood supply, and the surgical mind cannot imagine the replacement of a tooth root so that all broken ends of capillaries would rejoin; nor can we imagine the formation of a new system of blood vessels. At all events it is enough to say that all replaced teeth which become firmly fixed, if successfully retained, give off the same diagnostic sound above mentioned.

In another condition, we have diseased sockets, and loose teeth, or abscessed teeth; men have attempted cures by removing a tooth, enlarging the socket sufficiently to rid it of diseased bone and then splinting it back into its own place. This operation varies from the first or true implantation in two ways; the tooth is the tooth of the patient; and the socket starts as a focus of disease, however thoroughly the operation may be performed. Prognosis is less favorable than in either of the other cases, and the final loss of the tooth by absorption is more certain to occur.

There is one other implantation operation, which, however, is the rarest of all—the removal of a misplaced tooth, and planting of the same in proper position. I once did this myself. A cuspid erupted entirely within the arch, apparently too far from line to be bodily moved to place. Nevertheless the space for its accommodation was present. I extracted the cuspid, and within half an hour had it replanted in a newly made socket in proper alignment. The new socket included no part of the old. Of one hundred implantations, performed by me fifteen years ago, this is the only one which I consider permanently successful, and it is still in position. A dentist in the Northwest courteously wrote to me about a year ago that he had been called upon to place a small filling in the tooth, and was astonished to be told its history. He reported it to be in good condition. How much this result was due to the fact that the tooth belonged to the body in which it was replaced, and that it was removed and replaced aseptically cannot be known. My own view is that it was a phenomenal result not to be taken as a basis for future practice. In the presence of modern methods the forceps has no place in orthodontia.

The Retention of Implanted Teeth.

This brings us to a necessary but brief consideration of the retention of implanted teeth. When the operation was first introduced I had the opportunity of making some studies of this question from sections made by Dr. Heitzman. Unfortunately slides were made solely from implanted teeth which had first become firmly adherent, and had been subsequently lost. Under these circumstances I recognized at that time what an advantage it would be to have a cross section of an implanted tooth with adjacent bone still attached in order to learn abso-

lutely the nature of the union. To this end I extracted from a cat a lower incisor, which had a lengthy root of small diameter. This at my request was implanted into my own jaw by Dr. F. T. Van Woert. The operation was successful; the tooth became firmly attached and was kept in the mouth for a year. It had been my purpose to remove this tooth, with its adjacent alveolus, by means of a trephine, thus affording opportunity for cross sections and proper microscopic study. Unfortunately an adjacent tooth became diseased, and grew so troublesome that it was extracted under an anaesthetic. Later I discovered that the implanted cat's tooth had come away with a part of the process necessarily broken out because of the excementosed condition of the root removed. The extractor knowing nothing of this had thrown the whole mass away.

I had no favorable place within my own mouth for the repetition of the experiment, but I have no doubt now that some of our enthusiastic students may make the attempt and procure the data for us.

The following may be stated with reasonable assurance.

The drilling of socket causes of course a wound; this is practically a traumatic injury. If no tooth were placed therein what would occur? Repair, which means a rebuilding of bone. Bone formative cells, known as osteoblasts, would appear, and the socket or hole would be refilled with bone. The placing of a tooth within the wound in no wise alters this attempt at repair as a primary effort of nature. But the presence of a foreign body arouses a new activity. In injuries to bone where there is penetration, with retention of the foreign body, as in a gun shot wound, or a stab with the breaking off of the point of the piercing instrument, nature first tries to be rid of the foreign body; it is released by a resorption of the surrounding bone until the foreign body is sufficiently loosened to be extruded. The cell which accomplishes this is a giant cell, the osteoclast, and the operation is termed osteoclassis. This course follows in implanted teeth, and we have a duplex phenomenon; osteoblasts building up the destroyed bony walls, and osteoclasts attacking the intruder; for in this instance, the intruder being bony in structure it is the foreign body itself which is demolished. The tooth root is composed of dentine, covered with cementum; and cementum is the part of the tooth most analagous with bone, since it is traversed by lacunae. The rationale of the union therefore is this; the osteoclasts are eating into, and thus roughening, the cementum of the implanted tooth, while the osteoblasts are rebuilding the injured alveolus. Should there be no infection, and should the patient's reparative energies be normal, the rebuilding will be more rapid than the destruction, and the new bone will be builded closely around, and adherent with the cementum of the implanted tooth. But

curiously enough there is another possibility, which if true explains the final loss of implanted teeth. There can be no permanent union between alveolar bone, and dentine; the interposition of cementum is essential. Therefore if the osteoclassis is rapid, and penetration of the cementum to the dentine occurs, there may be union of the surrounding bone with the cementum which is left, but not with the exposed dentine. At the points where the dentine was uncovered, the osteoclassis apparently is not entirely overcome, though probably its future action is retarded. Thus it continues, and by slow but sure degrees the root is eaten away, the rapidity of the destruction increasing in proportion as the area destroyed is made larger, thus affording chance for greater activity.

My authority for the above views is based upon specimens which I distinctly recall, made by Dr. Heitzman. In his examination of shed implanted teeth, bay-like excavations were found, the work of the osteoclasts. But many of these teeth having been removed had been torn from the socket, rather than removed by absorption. Along these areas, the osteoclastic bays were microscopic, and in them could be seen particles of true bone, but never any bony masses adherent with dentine. Similar examination of temporary teeth lost by resorption will never show any bays in the cementum filled with bone. Pericementum always covers the uneroded surfaces of the cementum.

Thus in brief, implanted teeth are held by ankylosis, there being a firm bony attachment between the cement of the root, and the bone of the alveolus. Thus, union being without interposition of any membrane, which latter normally acts as a deadener of sound, we get as a diagnostic symptom of such ankylosis, a peculiar sound upon percussion, likened to the striking of a steel instrument upon a china plate.

The problem for the orthodontist is: "If upon percussion a living tooth gives off a similar sound, is ankylosis present?" In other words, "Can there be ankylosis of a living tooth" and if so is there any cure?

Ankylosis.

Ankylosis of joints, in the living subjects, without death of the parts are common. There may be death or partial death, necrosis, of some part of a joint, and this may indeed be the primary cause of the ankylosis. We must then study the whole subject of arthritis, and joint ankylosis, to find some analogies upon which to base probabilities in the region under discussion.

Joints are broadly classified under the terms synarthrosis, amphiarthrosis, and diarthrosis. The latter are the joints permitting mobility; the elbow, ankle, knee, temporo-mandibular, hip, etc. The entire mechanical usefulness of the body depending upon the power of movement,

it is not strange that the immobility of these joints through accident or disease, has received more attention by surgeons than have the other joints. Hence it is from what has been learned about the etiology and treatment of ankylosis of diarthrodial joints that we may find a basis for theorizing in regard to the synarthrodial.

Diarthrodial joints are more or less complex in their anatomical construction, but the special tissue to which I would attract your attention is the sinovial membrane. The various diseases of this membrane, and the phenomena which occur when it is gradually displaced during the formation of bone which eventually unites the articulating bones of a joint by ankylosis are to be studied in order that we may seek analogies between ankylosis of mobile joints, and ankylosis in tooth sockets.

It is worthy of note that synarthrosis means without movement: that under this term are included subdivisions, such as the sutura, which of course are strictly without motion. But also the anatomists have here placed the gomphosis, which not only is not an absolutely immobile joint, but unlike the sutura we do find a membrane between the bony parts.

What is this membrane?

Some histologists have called it pericementum. If this word be taken as analogous to the word periosteum, then the function of the membrane should have to do solely with the cementum. Other histologists have thought that the membrane is composed of two layers one periosteal in character, and the other pericemental. Such writers prefer the term periodontium.

When we come to consider the phenomenon of ankylosis in this region, the following is a pertinent question. To what extent does this membrane serve the purposes of the synovial membranes in other joints, and, therefore, to what extent will it similarly respond to similar injuries or diseases?

Without awaiting the reply of the histologists, I venture to state as my belief, that the formation of an ankylosis in a tooth socket will not vary greatly from the routine in the other joints, except as the environment compels limitations. For example, we may exclude those forms of ankylosis due to adhesions of tendons or other soft tissues; but the true bony union between the bony parts, I think will not be found to differ greatly in etiology.

It is not my purpose here to take up any extended consideration of ankylosis of diarthroidal joints, but those interested will find it profitable to procure a monograph on this subject by the eminent surgeon John B. Murphy of Chicago, which may be found in the *Journal of the American Medical Association,* May and June, 1905.

It will suffice here to point out that while many ankyloses have their origin in a trauma, there are many and very serious varieties resulting from diseases, such as rheumatic disturbances; as well as the suppurative types which may follow typhoid, scarlatina, pyemia, etc.

By analogy then, in seeking a cause for ankylosis in living teeth we are to investigate traumatisms, and internal infections. Of the former there are abundant possibilities, including one of vast import to the orthodontist, viz.: "May we move a developing tooth to such an extent that a traumatic lesion may be produced, which may lead to an ankylosis?"

In regard to internal infections, the studies of Kirk and others, of pericemental abscesses forming on living teeth, already afford sufficient proof that we may have inflammations of this membrane, without death of the pulp. Similar infections of the synovial membrane may result in ankylosis terminating in complete union, with disappearance of the membrane. Why not the same course in the tooth socket?

A Case from Practice.

Let me now give the history of the case which I have to report. Some years ago I received a patient aged between eight and nine. The upper central incisors had erupted, but were slightly separated. The laterals were in course of eruption, but were deflected distally and presenting with wide spaces between them and the centrals. A rubber band around the two centrals drew them together within three or four days. A figure 8 band was then thrown around the two centrals, and supplied an anchorage for the mesial movement of the laterals. To this figure 8 band was soldered a gold wire, with screw thread cut on the ends which were extended so as to reach and overlap the laterals. Each lateral carried a band on the labial face of which was a staple. The ends of the gold wire passed through these staples, and nuts were then used to gradually force the laterals into alignment. It should be remembered that the laterals were but partly erupted, and consequently pressure was applied guardedly, which is proven by the fact that this apparently simple operation covered about four months of time. The four teeth were thus nicely aligned, and a fixed retainer was worn for a year, when the case was dismissed.

Last year the young lady was brought to me again, now aged fifteen. Examination showed that one central incisor appeared to be but half erupted, causing a conspicuous deformity. Percussion showed a marked difference in sound from that given off by the adjacent teeth. A diagnosis of ankylosis was made.

As to the cause, the patient and her mother insisted that the shortening of the tooth was due to the too early attempt to regulate the teeth. In this view, the mother declared that she had the support of "celebrated dentists, both in Europe and America." All my confreres apparently

blamed me for the condition. I could obtain no trace of any history of traumatism, of the ordinary character; that is there was no recollection of a blow, fall, or any other disturbance of the tooth in its socket. It had never been loosened, not even by my regulating apparatus. A query of vast importance to us all is here to be answered. "Was this ankylosis attributable to the too early regulation, or to the manner of doing the work?" To properly determine this please do not overlook the following facts. The centrals were but slightly moved, scarcely more than is commonly done when separating for inserting gold fillings. This transit was accomplished within a week, after which the teeth were used jointly as an anchorage for moving the laterals. The laterals were moved a considerable distance. The teeth were properly aligned, and retained for a year, and the case when dismissed, a year after all movement had been completed, was in satisfactory state. Subsequently, either the three other teeth continued to develop in length, while the one tooth remained stationary, or else the ankylosed tooth was driven up in its socket. I am inclined to the first theory, that of arrest of eruption of this tooth, with progressive eruption of the others.

The next point of interest is the fact that prior to coming to me the child had been given into the care of another practitioner, who worked several months in an attempt to elongate the tooth and finally abandoned the effort. By the means which I shall relate I may state here that the tooth was finally brought down into true position within six weeks. The other gentleman used the well known device, consisting of caps cemented on adjacent teeth, connected by a stout bar, and traction from this bar to the tooth by means of rubber ligatures. Please note that this traction is in the direction of the long axis of the tooth.

I must furthermore state that the patient declined to permit an X-ray, on the ground that her skin was too tender to be thus exposed. In this the family was supported by a skin specialist, so that I could not argue the point. Because of the fact that I was supposed to have caused the deformity, I was anxious to attempt a cure, even under these adverse conditions.

Treatment. Having decided that ankylosis was present, I argued to myself that the tooth if moved at all, must be moved first *laterally* rather than vertically. I likened the condition to that of a screw in a board. A nail in a board may be withdrawn with vertical force, provided the leverage be great enough. The same force would fail to start a screw, whereas, movement of the screw laterally thus breaking up the attachment by enlarging the hole, will permit the withdrawal of the screw finally, with even less vertical force than was required to extract the nail.

In applying this principle to the tooth in question, I concluded that some vertical traction might be used however, coincidently with the lateral stress. The procedure was as follows. A platinum band was adjusted to the short central so accurately as to just reach the gum margin. The slightest exposure of enamel between the upper edge of the band and the gum margin would thus be the first sign of elongation of the tooth. To make this certain it was obligatory that no ligatures should pass around the tooth, thus possibly forcing the gum away and leaving me in doubt. To this band was attached a wide staple, high enough to just allow the passage of the finest wire. D bands were placed on the molars, with the tubes so pointed that the expansion arch when in place would fall below the incisive edges of the incisors. If this were then drawn up and lashed to the staple on the short tooth, vertical traction would result. The arch however was at first bent upward near the cuspids so as to cause very little if any vertical stress. When lashed to the central, lateral pressure was exerted by tightening the nuts in the tubes. Within a week slight lateral movement had occurred, and it became evident that I would succeed in breaking up the ankylosis. The arch was then made straight, and full vertical pressure applied, while heavy lateral pressure was also kept up. The patient was required to report immediately should any soreness result. This, however, did not occur. At the end of the fifth week a narrow line of enamel showed above the band, and I felt assured that the ankylosis had been overcome and that the tooth was elongating. The diagnostic sound on percussion had changed, and the sound emitted was the same as with the adjacent teeth. So certain was I that the tooth was moving, that I feared to continue the extreme pressure. I therefore again bent the arch, so that should it draw the tooth down to the limit of the tension of the wire, the tooth would be just the proper length and be it noted, there would then be no further tension. All lateral pressure was abandoned. That this precaution was wise was shown by the result. The patient was dismissed for three days, but was found at the office at eight thirty the next day, in a great state of excitement. The tooth was fully erupted. An examination was made to be sure that there was at that time no further tension of any sort, and that the appliance was simply acting as a retainer; assured of this the case was left severely alone for four or five days and a retainer was then placed.

A curious after result, may possibly lead us to an explanation of this singular case. Within three weeks of placing the retainer the patient returned to me reporting that the fixture had "broken." I found the band around the treated tooth partly severed by contact with the lower

incisors, and after considerable catechism discovered that the girl grinds her teeth together during sleep. As this particular tooth was originally slightly malposed, lingually, is it possible that during this act, she caught the incisal edge during this night grinding? If so, did this cause an irritation followed by an inflammation of the pericementum sufficient to result finally in the ankylosis?

Previous Reports of Ankylosis.

I have only been able to find one mention of ankylosis in the literature, and this is of interest. It is on pages 304-5 of Dr. Jackson's "Orthodontia." He reports a case of a lady aged twenty-three. The central was shorter than the other teeth, and the patient declared it had been fully erupted. This patient is at present in my hands. Jackson says the history was obscure, but that he finally learned that there had been a blow on the tooth. I have failed to get any similar admission from the patient. Jackson further says, "From a radiograph it was found that the root was straight but that no adhesions were perceptible, but it was evident, from the ankylosed condition, that the peridental membrane had been injured, and in the healing process a bony deposit had taken place connecting the tooth with the process." The above statement is very interesting. Dr. Jackson made a correct diagnosis, yet has not here or elsewhere in his book really discussed this highly important subject of ankylosis. Nor apparently did he appreciate the value of lateral stress in such a case. He describes his efforts at correction and declares that though the tooth had been elevated slightly it was not in a satisfactory position at the time of writing. It is now only a little more than half as long as it should be. Vertical traction in Jackson's hands applied with unusually powerful methods, failed to move the tooth. The fixation is so great, and the ankylosis apparently so extensive that it is only fair to Dr. Jackson to say that success of any effort to move this tooth is very doubtful.

Radiography of Ankyloses.

Dr. Jackson tells us that radiographs did not show the adhesions. This brings us to a most important feature of such cases. If we could but know exactly where the adhesions are, and the extent thereof, we would more intelligently work in the treatment. I believe it doubtful that much if any ankylosis can occur along the labial aspect because of the thinness of the bony plate. Osteoclassis sufficient to eat into the cementum, would destroy this plate, and infection supervening would bring about a pericemental abscess, a view borne out by the fact that all pericemental abscesses thus far reported have had fistulae opening through the labial or buccal gum. This leaves us three sides of the root on which to look for adhesions—the two approximal sides, and the lingual.

If the adhesion is along the approximal sides, the radiograph should show it; but the radiograph must be made with this particular point in view. As examples of what I mean I will show you radiographs of this case, which as Dr. Jackson says do not give evidence of the adhesions; then I will let you examine others which do. The whole diagnosis depends upon procuring a picture of the tooth, and adjacent teeth which clearly define the pericementum. It is evident that as the pericementum allows a freer passage of the light ray, than do the bony parts, the radiograph or let me for a moment call it a shadowgraph, should show a denser line around the tooth, than elsewhere. A clearly defined line of this character around a tooth indicates a space between the tooth and its socket. At any place where this line is absent theoretically there should be a union or at least very close juxtaposition of the root and alveolus. But diagnosis may be obscured by the character of the X-ray picture. The film must be developed to great density, in order to show great contrasts of light and shade. A dense film of this sort cannot well be examined by ordinary light but becomes very clear with the aid of a contrivance devised by Dr. Van Woert, which I have the pleasure of showing you. He has taken the ordinary fluoroscope box and replaced the end with thick cardboard, in which he has arranged a hole and pocket for carrying the film. Looked at in this way, all other light being kept from the eyes, very dense films are easily examined.

There are many interesting side questions in connection with this topic, and I may find opportunity to express more of my views during the discussion, but I have made this paper already too long.

Discussion.

Dr. Edward H. Angle. I am interested in this paper because it treats of problems novel and unique in the physiology of tooth movement. Yet I must tell you frankly I am a little skeptical as to there being such a thing as ankylosis in these cases, yet Dr. Ottolengui's evidence is quite convincing. If there is such a problem it is remarkable that the cases should be so very rare. However, I have had one or two cases where the teeth must have been ankylosed, if there be such a thing, for I know that they resisted all the force that I could apply, and that, too, by the best mechanical means I could devise.

I will describe one case which should be of interest for it has, incidentally, something to do with an important point in the history of one of the mechanical phases of orthodontia.

Many years ago a very beautiful young French lady was referred to me for the treatment of a central incisor which was fully one-eighth of

an inch shorter than its companion. In other respects the young lady's teeth were as near the ideal as I have ever seen, both in pattern and in occlusion. The lady inquired anxiously if this defect could be remedied and how much time would be required. I assured her that it could be remedied, and was quite positive that four days would be ample time (I was younger then). Well, I designed what I thought was a very neat, beautiful and efficient appliance. The tooth was banded and a button soldered to the labial surface of the band which engaged a delicate rubber ligature buttoned over a delicate cross-bar attached to bands on the adjoining lateral and central, all as shown in some of the early editions of my book. I remember how neat I thought it looked, and how satisfied I was that it would do the work. During the night I got to worrying for fear it might elongate the tooth too rapidly, and strangulate the pulp, or worse still, that the tooth might be forced nearly or quite out of its socket. But when the lady called again, to my great surprise the tooth had apparently not moved a particle. I put on an extra ligature, and after three days could still detect not the slightest movement of the tooth. Then I put on a third ligature. When she came again there had still been apparently not the slightest movement of this tooth, but the central and lateral used as anchor teeth had been forced perceptibly deeper in their sockets. I remember how this worried me and how fearful I was that they would remain so. You see I was a good deal younger then. So I enlisted the anchorage of two more of the adjoining teeth, and imagine my great surprise when they, in turn, were also depressed in their sockets. Well, I felt worried and humiliated, but not whipped, and I began to grope about for other means of anchorage, and the thought flashed upon me, "Why not extend the ligatures to buttons upon a bar attached to bands on the lower teeth?" Of course this was in sheer desperation. I did not suppose the young lady could then either talk or eat—but I was much younger then. In reality the wearing of this additional ligature annoyed her but little, and this, gentlemen, was the origin of the intermaxillary anchorage. It is illustrated on the case in question in the early editions of my book, and was also published in the Cosmos. I saw it was good and soon applied it in many other ways. But as to the tooth in question—notwithstanding all of this force being exerted, not the least particle that I could detect did it move. Instead of the promised four days, the operation had been prolonged into two anxious months. Gradually doubt had crept into the mind of the young lady, and doubt betrayed her over to skepticism, and skepticism to disgust, and disgust to the display of a temper that is said often to accompany black eyes, and the use of certain French words the meaning of which I never knew, but I have always thought

that probably they would not sound well in church. She left my office and vanished into the unknown and I never saw her afterwards.

I had never heard of an ankylosed tooth at that time, but never gave up speculating on the condition of that tooth. Now Dr. Ottolengui has helped me out. I had figured that the tooth must have a root like an enormous corkscrew, and that it wound straight up and was grown firmly to the parietal bone, but Dr. Ottolengui has greatly relieved my mind, and probably given us the true solution, and I hope we will all have our microscopes out for teeth in ankylosis and rapidly learn more about them.

Dr. O. W. White, Detroit, Mich.

I would like to ask Dr. Ottolengui if the new bone absorbed, and if there had been any absorption at the root why wouldn't some anchorage occur again when it is brought down? I understood the doctor to say that when the tooth was brought down he had the same sound as from a normal tooth. In time wouldn't some growth take place there again?

Dr. Robert Dunn, San Francisco, Cal.

I would like to report the case of a gentleman forty years of age where the superior cuspids erupted lingually, and in trying to bring them down the right cuspid was moved down without any difficulty, but the left as Dr. Angle has said, resisted all anchorage, and to-day I am trying to find out some way to bring that cuspid down.

Dr. George C. Cook, Chicago, Ill.

There are two or three points in the paper that are interesting to me. I have made a number of slides of decalified tissue, where the teeth had been extracted removing large portions of alveolus, and you have perhaps all seen many times that it is very hard to take off a piece of tissue from the cementum of the tooth. I never thought these slides would be of any special interest other than for my own curiosity, but there is a strange tissue change which takes place, which I think is decidedly different from that of ankylosis in synovial membranes. The synovial membrane, of course, is very different in its microscopic aspects from peridental membrane. Dr. Summa has spoken of radiating connective fibers in the peridental membrane. Both of them are elastic tissue to a certain extent, and it seems to be a physiological fact that tissue of that nature when disturbed is very likely to assume another physiological function. The physiological function is changed to the extent that there is a gradual deposit of lime salts in that connective tissue which goes on until you have a permanently formed bone that develops into normal bone tissue inasmuch as apparently the lime salts have been laid down

from two sources. Why it should come apparently from the cementum of the tooth is something that I am not able to give any explanation of, but apparently they unite. There is sometimes a definite line apparently formed right in the center, we might say, the longitudinal center of the peridental membrane. The changes are not sufficient to do away entirely with all of the elastic tissue, but there is enough calcific deposit from the alveolar portion of the cementum to make sometimes a permanent bone union, and instead of the bone union being removed from the cementum the union between the cementum and this newly formed bone structure is of such a nature as to tear away or break down a large portion of the alveolus, perhaps, in order to remove that tooth.

Dr. Ottolengui spoke of teeth that were replanted. I have made a number of examinations of tissue of that nature, and there is a tendency to take on the cell function and assume a condition in which it is capable of absorbing. The osteoclasts are simply cells whose functions are changed. They are the same cells, only in a changed condition. They have a tendency to absorb the calcific deposit. They would not attack any other substance than that of the inorganic salts. An illustration may be drawn like this: Certain trees grow on stony places. Their roots form a substance that will destroy the calcium in the rock, and therefore they get nutrition from the rock itself, rather than taking it from the earth. Those trees may be transferred from those stony places into soil, but you must furnish them a substance which they can break up, for the time being, at least. The so-called osteoclasts take on the function of destroying calcific material, and in so doing they form these notches, but I doubt from the microscopic examinations that I have made whether they have anything to do with the stability of the tooth.

The question that arose in my mind as to the breaking-up of that ankylosed condition was whether irritation had been established in this live tooth by some form of action in which this change had taken place in these elastic fibers. They no longer were elastic fibers, but had changed their function to fibers of calcification, and the more irritation you put on there the more likely it would be to become more active in the formation of the calcified condition.

Dr. Ottolengui. I am going to advance one more theory as to the possible ankylosis of that tooth. It is apparent from the casts that the tooth in its original condition in babyhood was longer than when it returned to me in its ankylosed condition. It seems likely that it has gone up in its socket.

Let me speak of a peculiar experience I had in the implantation of a bicuspid. The tooth appeared to be soundly attached, and occlusion was

correct. In about three months the patient returned for other work, and to my astonishment I noticed that the tooth was too short for occlusion, and still firmly attached. Six months later the tooth was only half its normal length, and still firmly attached. A year after that she came in and showed me that there was nothing of the tooth in sight except the cusps protruding from the gum. I extracted it. My only explanation of that is that the union was of such a character that it did not resist the force of mastication. In brief, there is contact of the morsal surface of the tooth with a foreign body of food, which may be sometimes very hard, and it was my opinion in that case that the tooth had been driven up in the socket because the union was not sufficiently firm to withstand the stress.

When we move the teeth in our operations we certainly loosen them. We expect that the alveolar tissues will resume their normal density, and that solidification around the sockets will recur. Suppose it does not occur? Then we would have the forces of mastication acting on the teeth and possibly causing some inflammatory action which may result in a cementitis, or some inflammation which starts the bony deposit.

Let me state why I think that lateral pressure will accomplish something when vertical pressure may not. I think in vertical stress the resistance is too great for the stress to cause the re-absorption of the normal tissue around the ankylosed portion. I think if I could take an X-ray, that the tooth would still have this attached bone on its side which originally caused the ankylosis. In moving it laterally you are dragging the ankylosed tissue away from practically a very weak attachment. If you drag it vertically you are endeavoring to move it the full distance of the ankylosed territory.*

An adjournment was then taken until Friday morning.

Heredity as an Etiological Factor in the Production of Malocclusion.

By Martin Dewey, D.D.S., M.D., Kansas City, Mo.

Read before the American Society of Orthodontists, Chicago, 1905.

Heredity as an etiological factor in the production of pathological and abnormal conditions, has always occupied a more or less important place

*At the time of sending the above to press, one year after treatment of the case reported, I am able to answer the question of Dr. White. I should have said, at the time of the discussion, that re-ankylosis would be a normal expectation. However it did not occur in my patient. The tooth has remained mobile in its socket. R.O.

in the medical and dental world. In early writings we find that prominent men have cited heredity as causing almost any pathological condition from carcinoma and tuberculosis to simple inflammation of the mucous membrane. As the knowledge of medicine advanced, as it became a more fixed science and guess work has been eliminated, we find the theory as to the influence of heredity has changed.

Among the late writers and investigators we find very few conditions are attributed to heredity. Even insanity, of which at one time there was no doubt that it was caused by heredity, is now considered by most men as the result of environment. If we remove the unfortunate individual, which the world has seen fit to brand with inherited insanity away from the surroundings which have been instrumental in producing the insanity of his family, and eliminate other factors, we find the tendency to the disease passes away. There was little doubt in the minds of old writers that tuberculosis might be inherited. Did they not see generation after generation practically wiped out by that dread disease, consumption? Of course they supposed it was the result of inheritance, and when Koch discovered and stated that the disease is the result of a germ contracted from surrounding conditions the world was slow to accept the discovery until it had been proven beyond question.

The discovery of bacteriology, the development of pathology, and increased knowledge in physiology and embryology have overthrown one theory after another as to the influence of heredity until now it remains in most cases as a past theory along with "laudable pus" and "the worm theory of decay." As one eminent writer said, "the development of modern embryology is a terrible blow to the theory of heredity.

Influence of Heredity on the Face.

As steps in the development of the embryo is noted and we see the gradual and slow growth, little room is left for heredity to play an important part. As we note the union of the two germ cells, the characteristic substance of which is chromatin, it is there that we must look for the influence of the force which the world terms heredity. The germ cells contain properties of both male and female, such as to produce the race and type, but further than that we can not go, and attribute certain malformations to heredity, as some are prone to do. We find much said about the laws of heredity and their influence in the production of malocclusion, but very little is said as to what those laws are. We find there are certain laws of heredity, but they are such as tend to *diminish* rather than *produce* malocclusion.

What, then, are the "laws of heredity," to which writers refer in speaking of such cases? One of the classes of cases which they speak

about and claim to be the result of heredity is where the individual is said to inherit the large maxilla and mandible of one parent and small cranium and face of the other. To the patient and layman such a statement seems plausible, and many a dentist has posed as a scientific (?) man while advocating such a theory, for theory only it is, as I know of no one who has produced such a case and proven it to be true. If you stop to analyze such a case as result of inharmonious inheritance the first question is how would it be possible? As we study the development of the embryo and see the bones of the head and face as they are formed from the cells of the mesoderm it is impossible to say which cells form certain bones and which forms some other, but as the process of nature proceeds we see certain bones develop in cartilage and others in membrane. There is always a harmonious relation existing between these parts. Why should nature develop the bone in a growing structure which is too large while developing by its side would be one which is too small? One would think from the writings of some authors who treat the subject of heredity as producing inharmonies of the bones of the face, as well as malocclusion, that the growth of the embryo proceeded along the same lines as that of the construction of a machine. That instead of the embryo being developed by a natural growth resulting from the union of two separate cells that nature chose from parts already formed; that in the rush of life nature chose parts that did not harmonize. That nature chose the ready-made jaws of a large parent and used them with a small face of the other parent. How else could such a condition take place as jaws too large for the face?

The bones of the head and face, with the exception of the mandible are so closely and intimately related that it is impossible for one to assume too great a size without affecting the other. I again ask how the development of such a condition is carried out?

They are so arranged and articulated that for one to be too large, the entire osseous framework of the head and face would have to be made over. The bones would have to be rearranged and replaced in order to make them fulfil their proper function. And where is the man that can point to any such marked change as would be necessary to make this inheritance of misfit jaws possible? How does it occur?

Large Teeth in Small Jaws.

Likewise the old theory of large teeth in small jaws. How does that occur? Advocates of the theory say that the child inherits large teeth of one parent and small jaws of the other, but they fail to show how this is possible. They see teeth which are crowded because of one or more of many acquired causes. Also the teeth may appear large

because at the time of the eruption the teeth are full sized and the features not fully matured. In other words the teeth which are the same size as in an adult, are noted in the face of a child which, of course, causes the teeth to appear large.

Some acquired cause is present which produces malocclusion and is the direct cause of the "irregularity." Instead of looking for some direct cause the writers who believe in the theory of inheritance of large teeth and small jaws in attempting to support their theory of crowded teeth in arches which are not developed, say that "it has been given as a reason for this condition that a child may inherit the jaws of one parent and the teeth of another, then for the lack of a better explanation it may be well to accept this for the present."

We know that in science an affirmative or a negative statement proves nothing. Nevertheless we find men standing high in the dental profession, and who would pose as authorities on orthodontia, making such a statement, as "for the lack of a better explanation it is well to accept this one for the present."

The question in my mind is, can it be accepted in the face of other knowledge? The child might inherit the small jaws and large teeth if the teeth were ready made and placed in the arches; or if the individual were constructed from certain parts of one parent and corresponding parts of the other we might find an inharmony of parts by improper selection, but the embryo is not formed by the assembling of parts selected from each of the parents, but development takes place by the division of a growth of cells and each organ of the structure is formed by those cells as growth of the embryo demands. We find up to a certain time it is impossible to say which cell will form this organ and what cell will form some other. Neither can we tell up to a certain time which cells will be used in the formation of the jaw, and which one will go to form the tooth. As the growth of the embryo goes on, and we find certain cells forming the dental papilla which becomes a tooth germ, and the other cells which lay next to it, sister cells in fact, and were entirely the same until nature called them, go on and form the jaws. The tooth, with the exception of the enamel, and the jaws, are developed from cells which were exactly the same up to the time of the special development. We find they were cells which lay side by side, sister cells which were formed by the division of a mother cell, one of which will be used in what later develops into a tooth and the other will be used in the growth of the jaw. How then occurs the awful inharmony which we hear about? How this inheritance of large teeth and small jaws when you find the teeth are developed along with the jaw?

All cases of large teeth and small jaws which I have heard about have always been in the permanent set. If such a condition exists in the permanent teeth, would it not be reasonable to expect to see as many in the temporary set?

If they are seen why are they not reported? As they have not been reported I conclude they are not seen. If inheritance plays such an important part in producing malocclusions of the permanent set would it not be reasonable to expect the temporary teeth to be affected as much as the permanent ones, as the framework of the temporary teeth is formed and jaws developed in utero when the influence of heredity has more of a chance to act than in after life when other environments are present. If such inherited conditions do not exist in the temporary teeth would it not be well to look elsewhere for the cause of a condition that is not seen until the permanent teeth erupt and many environments and acquired causes have had a chance to act?

Heredity has been held as producing a type of cases known as family traits. By that is meant some form of malocclusion which is found in the parent and is also present in the children.

Malocclusion not Transmitted.

This type of malocclusion, which has been classed as family traits, may be anything from the rotation of a single tooth, to cases of protrusion or retrusion of either the upper or lower teeth, pro or sub mandibular development. In fact all of the different class of malocclusion have at some time or other been attributed to family traits.

Very often when we are examining the teeth of a child the mother will inform us that the child's teeth are like the father's, or in other cases it may be like the mother's. In most cases if the teeth of child and parent are examined we will find no more similarity than is found in any other case of malocclusion in which there exists no relationship. In other words, we do see similar malocclusion in parent or child or in children of the same family. We may have a bunching of anterior teeth which are similar, but is that proof that family traits are responsible?

Men who advocate the theory of family traits and inherited malocclusion point to the children who have the same facial outline and general build of a parent. While a child may inherit the build and facial contour and makeup of the parent, such characteristics as speech, walk and mental disposition, are acquired from association with the parent rather than inherited.

Effects of Environment.

A type of malocclusion which is often considered as a family trait is that of Class 2, of either Division 1 or 2. One or both of the parents will have retreating lower jaw, teeth and chin, with protruding upper;

and one or more of the children will have the same malocclusion. Of course, the parent and some dentists can see in this a clear case of family type; an indisputable case of inherited malocclusion. A careful review of the case in most instances yields a history of inflammation of the mucous membrane of the nose and throat, adenoids and nasal obstruction and mouth-breathing in both parent and child.

The history of the parent is the history of the child. What the child endures so did the mother. They were all raised in the same environment, brought up with the same plan of house-heating and ventilation, and all have been more or less sufferers of so-called "colds." An examination of nasal passages will reveal the same pathological conditions and still we are told that family traits are responsible for this and other types of malocclusion when environment and acquired causes have to be literally pushed out of the way and thrown aside in order to uphold the old theory of heredity.

Cleft palate and harelip have by some men been classed as the result of inheritance, but as it is a more noticeable deformity than the majority of malocclusion, men have given more time to the study of such condition and the collection of data, until at the present time heredity is thought to play no definite part in the production of the cleft palate or harelip. The deformity sometimes exists in several children of the same family, but no history of cases before may be found, nor is the deformity often seen in the children of parents who have harelip. It may be found in the children of parents who have harelip in *very rare cases,* but in the majority of the children it is absent. We find no trace of harelip or cleft palate being transmitted from parent to child in case even where the mother has suffered mentally by the dread and fear that the child would be born with either of the deformities. This has a tendency also to overthrow the theory of the nervous condition of the mother being responsible for malocclusion of the child, and the old theory of nervous influence should be overthrown, because, in the face of modern embryology, how can such a thing exist? We know that the nervous system of the mother and the child is separate and distinct. At no time in life do we find a nervous impulse of the mother being carried to the child. Not only do we have a lack of nervous connection, but also we have no arterial nor veinous connection. Not a drop of the mother's blood ever enters the embryo. The embryonic germ is free from the maternal structure as far as nervous or circulatory systems are concerned. It then follows that the influence of inheritance or force of heredity is found only in the ova and spermatazoa, and after the union of those elements there can be no more characteristics or peculiarities of the parents assumed by the embryo.

In the face of this evidence the question in my mind is: Is not heredity as an etiological factor in the production of malocclusion given too important a part in the minds of some writers?

I think it is. In the past the opinion of some men and their theories have been accepted until they have become to some so-called facts as to laws of inheritance. If heredity does play such an important part and produces malocclusion as is claimed for it, proof must be advanced, and not theories. As our knowledge of embryology, physiology and pathology have advanced, the room for heredity has been limited. The influence which it plays must be shown, and in showing cases which are supposed to result from heredity writers must acknowledge environment and acquired causes, and not name congenital condition as the result of inheritance; and when they so arrange their theories as to remove every reason of doubt, then will we be able to tell the exact influence of heredity in the production of malocclusion.

Discussion.

Dr. Burt Abell, Toledo, Ohio.

After what we had yesterday along this line from Dr. Summa and Dr. Noyes, and Dr. Dewey this morning, it seems almost an impertinence for me to attempt to speak on the subject. I agree with Dr. Dewey that there is never present these large teeth and small jaws, and I think he stated that the reason of it is because of this inter-dependence of parts; however, he has attacked the law of heredity, and it seems to me has confined it to one generation, which is hardly fair. I think we ought to give due credit to the laws of heredity in malocclusion. No one denies that there are extraneous elements which enter, but I do believe there are also hereditary influences. We really *know* nothing about it, and are compelled to judge from what we can find out in the laboratory, from what we can see in different cases, and from what we can reason from conditions existing in the lower animals.

The human body has always been taken as a type of beauty. I have been interested in reading Metchnikoff, who has charge of the Pasteur Institute in Paris. He states that in earlier times people had tried in art to improve the beauty of the body by adding wings and other things like that, but that they had to come back to the human body as the highest type of beauty, and yet he states that Weiderscheim has taken the trouble to look up points of inharmony in the different parts of the body, and has found one hundred and five different rudimentary structures that are not in use and that are out of harmony with their surroundings. He has found seventeen more or less rudimentary structures

still in use. He has found fifteen in which we are better off than our Simian ancestors. If I had time I would like to speak of the different features, but it is not advisable at this hour. I will name a few of them. The hair itself is one of the things handed down to us, and yet it is not necessary; the stomach also, and the colon. People live without them. Even the coccyx is just the remains of the tail of the lower animal. The muscles of the ear are rudimentary, and so on. These are all hereditary, and follow what I believe to be the law of type. A certain type is reproduced. I think Dr. Summa told us yesterday that this same law that would produce a type is constant in what we term family traits. It seems to me those are two terms, one generic and the other specific. There is one instance that is interesting. Dennecker had the advantage of studying the fœtus of the anthropoid apes. He found, up to the fifth month, there is a striking similarity between the fœtus of the ape and man; but then there comes a stimulation of the cells that form the jaws, and from that time on there is a growth away from what we see in man. In the bulldog we see the arrested development of the upper jaw. It seems to me there is the same law there, one handed down because of the type, the other handed down for a short time, because the bulldog is a modern product, so to speak. The great horticulturist Burbank at one time was near a bed of verbenas and noticed a fragrance that was never present before. He discovered among the many plants which one it was, and saving the seed from the plant, he is now giving us verbenas that have a delicious fragrance. We all know how that power of selection works in the lower animals. A certain feature appears, or by a certain union certain markings appear, as on the feather of a hen, etc., and can be perpetuated by intelligent selection.

Now this point occurs to me: Man has *always* been more or less afflicted with malocclusion. There has not been an intelligent selection, but, what we would call in the lower animals, a haphazard mating; consequently we have not had well-defined classes of malocclusion, so that we can not readily come to a conclusion along this line of heredity. I think you can not disregard the powers of heredity because that is the way we can trace back through the lower animals. Even granted that we may not directly inherit malocclusion, yet we inherit certain tendencies that produce malocclusion. For instance, in the class to which Dr. Dewey called attention, Class 2, Division 1, I believe there is an inherited condition which would influence or cause adenoids or hay fever, and the power of heredity might give an individual a certain constitution which would produce this particular malocclusion. A certain tendency on the part of an individual to do a certain thing by which he brought about a certain condition might produce a disease.

We have been told that it takes thousands of years to make an artificial condition hereditary, and the example was given of the bound feet of the Chinese women. That leads to this statement: The very prevalence of malocclusion is an argument that it is handed down to us from one generation to another, and that it is not alone caused by extraneous circumstances, or else that we would find no malocclusion except where we could definitely point to these outside circumstances. I believe we have no ground to condemn the influence of heredity until we have tried intelligently to reproduce malocclusion through the power of selection.

Dr. S. E. Dodson, Grand Rapids, Mich.

I have a slight knowledge of dogs, and can state that in early puppyhood the jaws are alike in development, but at about six months the upper ceases in its development, while the lower goes on. This leaves them in the same condition we often notice in orthodontia, Class 1. You have an apparent protrusion (lower) when, as a matter of fact, there is an under development of the upper jaw as the *real* condition.

I would like to ask Dr. Dewey if he means to say that heredity is *not* a factor in the production of malocclusion? The trend of the paper appears to be that way, but it does not leave me clear on that point.

Dr. Lourie told us yesterday not to be too radical about the statements we make, because, as some one has remarked, they go in print and stay there for a long time.

For my part, I do not think it would be wise for us to wholly eliminate heredity as a possible factor in malocclusion. It seems to me that we do inherit certain tendencies. Dr. Dewey spoke of not inheriting insanity nor tuberculosis, which is probably true, in a measure, but I think every one will admit that you do inherit the tendency. On the other hand, it is well known that people are born idiots and imbeciles, when the environment could not have had anything to do with it. I think we have all seen faces that it would be very easy to produce malocclusion in.

I can heartily endorse Dr. Dewey's paper with the exception of his radical statements in regard to heredity.

Dr. Dewey.

Dr. Abell followed out the same line of argument which I tried to show you that the old writers followed. He failed to show you how the laws of heredity would produce malocclusion. Simply stating that such laws as this exist does not prove the fact. If those laws act it ought to be shown how they do act. We have a condition in lower animals similar to the one pointed out in man, the large teeth and the small jaws, and if that condition is to be found in man, why would you not find small

fingers on large hands? If you find it in man, why do you not find it in lower animals. The ovum and spermatozoa contain elements that produce a type of race, but we can not say that they produce pathological developments.

Dr. Abell bears out my statement when he speaks of the fœtus of the man and the ape, and says that they are the same up to a certain time. That shows that they are produced from two cells, and about the end of the fifth month there is a gradual change which takes place. There are laws of heredity, but they do not produce the abnormal, because as soon as abnormality appears it is not heredity.

In answer to Dr. Dodson's statement I will say that I do not believe that heredity plays any part in the production of malocclusion. Heredity produces the normal, but not the abnormal. Neither do we find inherited tendencies toward mouth-breathing. Adenoids and inflammations of the mucous membrane are the result of environment. The child may inherit the environment, but not the tendency to inflammation of the mucous membrane and mouth-breathing; neither does he inherit the disease known as tuberculosis. In regard to idiocy: We sometimes find idiots in the best families. We also find insanity among the old families of England, where the people were all born and brought up in the same section of the country. If a child has insanity, the family fears it, and it is brought about in other members of the family by fear. I think heredity, as an etiological factor in malocclusion, plays no part at all.

CLINICAL DEMONSTRATIONS

A Practical Bridge Tooth.

By A. H. Brown, D.D.S., Hamilton, Mo.

Clinic prepared specially for Items of Interest.

Becoming dissatisfied with ordinary facings, I have for the past five years been considering carefully the subject of replaceable teeth.

Beginning with setting up the teeth leaving the pins straight, removing the facings and filling the holes left by the pins with pencil carbons, investing and soldering the metal parts, finishing and finally putting the facings in place and heading the pins on the lingual side, I have followed a somewhat devious course of evolution and here give my final conclusions with a description of the tooth which most nearly meets the requirements. In my judgment present style facings cannot be relied upon unless heavily tipped with gold and even then too often our fondest hopes become sources of disappointment and chagrin.

To the extent that bridgework has supplanted the partial plate in prosthodontia, replaceable facings and teeth are destined to supersede the present style of facings in crown and bridgework.

The question is fast coming to be, "which of the several replaceable facings are indicated?" rather than, "are old or new style teeth to be employed?"

The fact that they are of many different constructions proves their adaptability and a growing demand for them.

It is not claimed the tooth which I offer is adaptable to every case, but I believe that when made in a suitable variety of moulds it will be indicated in a greater number of cases than those now in use. For, should a very close bite necessitate grinding away all of the lingual projection of the anterior teeth, there would still be, by virtue of the pins, the gold at gingival aspect of tooth and in the approximal grooves, a much stronger means of attachment than is afforded by any facing now in use.

I would say by way of explanation that the drawings from which these cuts were made represent the efforts of one wholly unfamiliar with teeth and are, therefore, not all that might be desired. They will fulfil their purpose if they illustrate the idea.

Description.

Fig. 1 represents an approximal view of a central incisor, and Fig. 2 a view in perspective of same. This is the general form for centrals, laterals and cuspids which, as will be seen, very nearly resemble vulcanite teeth, having each a fully contoured incisal third, a shoulder on the lingual aspect and two-headed pins baked into the lingual surface. The difference lies in the fact that to facilitate the accurate fit of the retainer, to be described

Fig. 1.

Fig. 2.

Fig. 3.

later, both surfaces of the step must be flat, and that the grooves in the retainer shall not be too deep, the pins must be shorter than in vulcanite teeth.

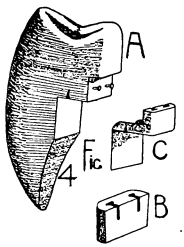
The bicuspids and molars do not so nearly resemble vulcanite teeth from the fact that to give greater resisting surface to the tooth and allow more room for metal portion of bridge, to meet requirements of strength, it is necessary to form a second step or stress-resisting surface, near the center of tooth bucco-lingually, as shown in Fig. 3.

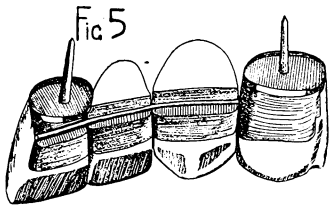
The same relation of the pins to the shoulder is observed in the bicuspids and molars as in the anterior teeth.

The gingival surface, or shoulder, of first step is almost at right angles, though slightly oblique, to the length of tooth, while the second step is decidedly oblique to length of tooth.

The retainer, Fig. 4-B, is of solid metal of sufficient thickness and width to occupy the first step, conforming to the contour of the linguo-proximal angles and continuing the lines of all the surfaces directly toward the gingival. It is provided with open-sided sockets, or grooves, on the side presented to the tooth, of sufficient size to accommodate the pins and to allow the retainer to be pushed to place from the gingival toward the occlusal.

Construction. In constructing a crown, a cap and dowel are made and placed in position as for a Richmond crown. The impression and bite are taken, model made and mounted in articulator, tooth selected and ground to place. A strip of pure gold of 34 or 36 gauge is now soldered to the gingival surface of retainer, allowing it to protrude enough labially, or buccally, to be conformed to the inequalities of the gingival surface of the tooth and overlap slightly at labial or buccal extremity. It should also be wide enough to extend about one and one-half millimeters beyond the approximal edges of the tooth, over which it is turned and conformed to the mesial and distal surfaces forming a box into which the tooth fits.





After the tooth is ground to place, grooves are cut in the approximal surfaces as shown in the illustrations. They are placed longitudinally in the gingivo-proximal angles near the center of tooth, being designed to give it the maximum of stability. The gold plate should be burnished into these grooves while being adapted to the approximal surfaces. In soldering, the grooves in the gold will be filled with solder, making a solid body of metal accurately fitting the grooves in the tooth.

After cutting away the gold so as to leave none to show in the finished work, the tooth is placed in the box and then on the cap and articulated. It is then waxed to place being careful that no wax touches the tooth, but unites the metal parts firmly. The tooth is then removed while the metal parts are invested, soldered and finished, after which the assembling is done with cement or gutta percha.

In preparing the teeth to be used as dummies the same procedure is followed except that the gold plate is allowed to extend only so far toward the labial, or buccal, extremity of gingival surface as it is desired to have the solder flow.

Fig. 4 shows a tooth with box detached.

In constructing a bridge the best results may be expected and time saved, by making only the cap and dowel of crowns and soldering the

metal parts as the bridge is soldered. Iridio-platinum wire may be allowed to extend the whole length of bridge and into crowns if desired, as shown in Fig. 5.

A Modified Form.

Fig. 6 shows a sectional view of a modified form of the tooth. It could be made at less expense than the one just described, and for bicuspids and molars would, I think, answer every purpose.

In this tooth there are no pins, but in the surface where the pins would be in the tooth just described, there is a cone-shaped socket having its base disposed inward.

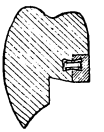


Fig. 6.

The retainer to be used with this tooth, instead of having open-sided sockets, has a socket exactly like that in the tooth, in such position that when it is in position on tooth, the openings approximate each other.

A strong double-headed pin is provided with each tooth, long enough to reach from the base of one socket to the base of the other, the heads of the pin being just large enough to enter the openings.

In construction, the same procedure is followed as described in connection with the other teeth, but in the final setting of the tooth, the sockets are filled with cement, the pin placed in one cavity and tooth pressed to place in box.

The fact that the tooth sets in a box makes this form amply strong.

Among the advantages which will occur to dentists are these: Most easily replaceable; adaptable to either crown or dummy and to any tooth; teeth are not subjected to heat; absence of any visible gold; the comparatively small amount of gold required; the life-like translucency of incisal edge of anterior teeth; the tooth and retainer preserve the natural contour of tooth on the lingual, presenting a broad, smooth surface to the tongue; the finished work is stronger, contains a minimum amount of gold and is esthetically perfect.

Hollow Gold Inlays.

By D. T. Hill, D.D.S., Syracuse, Neb.

Clinic prepared especially for Items of Interest.

Without argument, we assume that in positions where great stress is possible, gold is preferable to porcelain, for reasons so well known that we refrain from occupying valuable space by explanations.

The inlay can be constructed in a manner which assures a most perfect fit, and being made out of the mouth, relieves the patient from all suffering and annoyance; and last, but not least, relieves the dentist from the racking nerve tension incident to long operations. Perfect fit is essential, and is the first object to be attained, and can be accomplished more perfectly by burnishing a thin matrix to the wall, than metal can be driven to the wall by the plugger point; at least that seems to be the clinical experience of many.

That the principal of mechanical retention, by undercutting the wall at favorable points, which has been practiced so long, would be desirable, those lacking faith in the adhesive quality of cement will claim. These undercuts exclude the possibility of withdrawing the matrix without distortion, and, therefore, are not admissible at the time of making the matrix.

Hollow Inlay with Pin Anchorage.

I will briefly describe two cases which will illustrate a method by which, first, the gold inlay is made hollow, thus allowing a maximum of cement and a minimum of metal; second, mechanical attachment is made between tooth and inlay; these to be inserted in teeth with living pulps.

We will take the case of a central incisor, with an approximal cavity extending well up to the gum, with the point of the tooth so broken away that it becomes necessary to restore the incisal edge one-third the width of the tooth. We would trim the enamel down to a solid smooth base, without regard to cavity formation further than a smooth floor. With a fissure drill make a step or depression along the cervical wall and at right angles with it, with a slight undercut, which is admissible, because the matrix will be drawn downward when removed; make the matrix over this plane by the usual method, or the one which may suit best, working the foil well into the step and slight undercut and carefully lapping the foil over the edge of the enamel at all points. When this is attained, take soft salted plaster, and with a small burnisher run a small amount over the edge of foil which laps the enamel, and onto the labial surface of the tooth; now

run a small amount of plaster along the edge on the palatal surface; as soon as this plaster has set the matrix will be held in position by it, when more plaster may be run over the matrix, the labial surface, and the incisal edge and thickened up so it can be taken from the tooth without breakage; into this impression, after oiling the plaster only, run investment which will give us a model of the labial surface of tooth and incisal edge, with matrix in model; now fill matrix with wax and carve to contour which can be done without replacing in the tooth, as we have a model of the labial surface of the tooth and incisal edge. Carve the wax away the thickness of 30 gauge gold plate, which will show a definite line where the foil laps the enamel. Take an impression of this wax, being careful that the plaster runs over the edge of the foil. After this plaster has set remove and trim down to a smooth edge where the foil makes a turn over the enamel; press the impression full of moldine, and then on to a piece of moldine; remove impression, set rubber ring and run die of Melott's metal. Take 30 gauge gold crown plate and drive, with this die; the edge will be plainly marked. Trim to this edge and fit in position which should fit edge of matrix at all points; wax this contour to matrix. Mix more investment and press investment model of tooth with matrix into it, matrix up, and well exposed; now run a small amount of investment over center of gold contour bringing the investment over in a circular form until it runs on to the investment base, thus holding the contour in position and exposing all points to be soldered; after investment has set, heat up slowly and solder contour to matrix. We now have a contour which will restore tooth form and a matrix absolutely unchanged, which will be found to go to place with great accuracy, with a hollow inlay thus secured.

Next, take a spear drill slightly larger than a tooth pin, and drill into the tooth at a point where the enamel comes together from the labial and palatal walls; this will be found to be far enough from the pulp to cause no annoyance. Select a tooth pin from a rubber tooth and fit into this drill hole, allowing the head of the pin to come out far enough to enter the contour, roughen up the pin and set with cement; now cut through the foil at a point which will admit the pin head, fill the contour with cement, place cement over the floor of the cavity and press home to place. After the cement has set dress edges down true and polish. We thus have a hollow contour, the edges of which fit as well as a solid inlay could, held in position by a step plug at the cervex, and at the point held by an unyielding pin. I have many incisors restored by the use of the pin set as described, not only by this inlay plan, but by the contour filling (a description of which appeared in the ITEMS OF INTEREST, March, 1904).

Mechanical Retention.

To secure an inlay without a pin, but with mechanical anchorage, we will take an upper molar; cavity in mesial surface extending from gum line to grinding surface. After removing all decay, and securing a smooth floor, dress the buccal and lingual walls to desired extension, making their lines parallel with each other, or slightly wider near the grinding surface; dovetail these walls their entire length. Make matrix in usual way, taking care that the foil fits nicely over the edges of all walls. Remove matrix by drawing it down and out of the undercuts which have been made under the buccal and lingual walls. Invest this matrix and after investment has set, fill the matrix two-thirds full of investment; after this has set round this investment so the floor will be exposed at the edges. Now take platinum foil and lay over it, burnishing it down to the investment so that the edge will come to the deepest portion of the inlay at its deep edge. Heat all up slowly and with the blow-pipe fill the balance of the matrix with 22 K gold, or pure gold as desired. We now have the matrix two-thirds full of investment and the last third with gold; cut out the floor of the matrix near its edge, wash out investment, and we have a hollow gold inlay, with but little metal, dove-tailed to place when set. To set fill inlay with cement, smear a small amount in cavity and slide inlay to place as you would press a drawer to place in a table. The stress incident to mastication can have no effect on this inlay because it was introduced into the cavity from the grinding surface and rests on a firm base at the cervex.

Inlays in cavities, where all the walls are standing may be anchored to place by allowing the investment to fill the matrix half or two-thirds full at the point where the undercut is made; after cutting out the floor of the matrix, the side of the matrix is to be cut down to the gold, leaving a sort of trap-door. By filling this part of the inlay flush, and having the cement slightly stiffer than that which is used in the cavity, the pressure on the harder cement in the matrix will throw these wings of the matrix into the undercut where the cement is more yielding.

EDITORIAL

Interchange of License.

Experience with the Asheville Resolution.

It is now three years since, at Asheville, the National Association of Dental Examiners passed a resolution recommending the granting of an interchange of licenses between the States of the United States. This embodied the terms under which such interchange was to be regulated, and has since been referred to as the "Asheville Resolution."

It is with regret that we feel obliged to announce that the Asheville Resolution has not entirely succeeded. In the first place, only a limited number of Examining Boards have announced their willingness, or their ability, to grant the interchange, though nearly all the examiners present at Asheville had there voted in favor of this scheme of reciprocity. Of the States which did undertake such interchange, New Jersey stands as the leader, and yet we have just learned that in the three years that have passed, even New Jersey has not issued a single interchange license under the terms of the Asheville Resolution.

Cause of the Failure.

The Asheville Resolution provides that the applicant must have been in practice for five years prior to asking for the interchange from another State. Thus far there have been numerous requests for such

licenses, but none had been five years in practice. Thus we learn that a man who has been five years in practice is not apt to be anxious to make a change. Of course occasions will arise where men will wish to move their residence and practice even after dwelling for five years or more in one locality, but seemingly such cases will be limited. At all events no such dentist has desired to move into the State of New Jersey during the past three years.

Those that have asked for the interchange license apparently were unaware of this conditional clause, as all were young practitioners who had not succeeded up to their expectations where they had first started, and hoping to do better sought a change of scene. These facts are significant and must be considered in the framing of any interchange plan that will be destined to be permanent. Perhaps it would be wiser to reduce the limit to three years. There must be some such restriction in order to prevent young graduates from shirking an examination before the board of the state in which they really intend to practice.

In this connection it should likewise be recorded that New York and New Jersey have a reciprocal interchange based on equality of educational standards, but not restricted by the five-year clause, and that under this method a number of exchanges have been made to and from both States. Yet a few men have seemed to prefer to pass the board of one state as a means of obtaining license in the other. This is scarcely the true object of the interchange of license.

If the National Association of Dental Examiners will consider this problem at Atlanta it is possible that they might formulate a plan which not only will supply interchange, but tend toward developing more equal requirements in the States. Certainly it is time that the standards should be the same throughout the country.

THERE'S QUITE A BIT of twaddle about Bacteria, these days. The way some folks act when face to face, as it were, with one of these little creatures, you'd think it was a bull dog. I've seen a woman turn round in a dental chair and stare at the napkin on the head-rest, till you would almost fancy you could see a spider there yourself. Then she says, cold and hard like, "Is that napkin sterilized," and you answer softly and meekly, "Yes'm." Then she looks at you and says nothing as she leans her head gingerly against the cloth, but she thinks you are a liar; and you wonder whether you are, because really you don't know whether your Laundry Lady uses soda in the wash water or not, though you suspect she does, from the holes. Just then you notice the color of that lady patient's hair, and you feel relieved, because bacteria don't thrive on peroxide, now, do they? But why is the woman so scared?

THE WORLD is thousands of years old, and some folks think it is older even than that; the men and women in the world have been eating and drinking and digesting bacteria all that time. Yet suddenly Folks have become so frightened about the matter that many a strong man will walk half a block out of his way sooner than pass a little Bacterium on the street. Now don't misunderstand me. I'm not exactly advising you to cultivate Bacteria, not unless you have a laboratory to do it in and know how to protect yourself: because I am told that there are a few germs that will take advantage of the least intimacy that is accorded to them. You allow one of that sort to reside with you, as it were, for twenty-four hours, and Lo! when you look for him the

next day you can't identify him from the millions of his friends that he has invited to visit him. And then, of course, you have trouble to evict all that crowd. In which respect they are much like your country relations that drop in on you in the winter time, when all the theatres are open.

NEVERTHELESS it hardly seems fair to condemn a whole flock just because there are a few black sheep. At all events it is not really scientific. It is not sportsmanlike either. What would you think of a fisherman who would put dynamite in a lake, because he had heard, that some one had told some other fellow, that he had suspected, that at some time the lake had been stocked with trout? What would be the result of that kind of fishing anyway? He would probably kill a thousand fish and other swimming things that ought to have remained alive, without getting a single trout. Because often the trout hide under a bank, or maybe they were up the brook visiting when the explosion took place.

ISN'T IT MUCH the same with the haphazard sterilization practiced in the majority of dental offices? What is the usual custom? Boil! Now a a boiled Bacterium, they tell me, ceases to propagate or to invite his friends to visit him for the summer, especially if you boil him long enough. So I say, if you are sure of your Bacterium, boil him by all means. But in this matter, it is much the same as with the classic directions for making a Welsh rabbit. The experienced rabbit maker tells us that we should first, "catch the rabbit."

A WESTERN FRIEND of mine says that the most satisfactory treatment of a Bacterium is to "shoot him in the heel."

BOILING MAY BE discouraging to Bacteria, but it is likewise somewhat discouraging to the owners of the instruments that are boiled. I've seen a new instrument made into a second-hand tool in twenty minutes, and without any particular advantage, because it happened, first, that there were no Bacteria on the tool; second, that it was a tool that never touches anything that the Bacteria would care to consume; and lastly, because it was the sort of tool that could not transmit disease, not if it made a special effort to do so. Perhaps you think there aren't any tools in that class. But there are. Just for instance, what about the various instruments that you pass through the flame and use right hot? Don't you think that heating immediately before use, is quite sufficiently discouraging to any Bacterium that may be resting thereon? And your

gold pluggers? If you always apply the rubber dam, and properly use your pluggers, do they ever touch anything except the gold? Now suppose a tiny, little, lonely Bacterium happened to be on your plugger and should slide off from the jarring of the mallet? Wouldn't he alight on that gold filling and in a jiffy would he not be the only inhabitant of a solid gold brick? And do you think he would know his way about in that environment?

NOW DON'T TELL me that the plugger might slip, and tear the rubber and get blood on it, and that blood usually has more or less Bacteria present. Because first I say to you "fend slips"; and second I ask, "does your plugger always slip and tear the rubber and draw blood?" Because, of course, if you admit that, I must advise you to boil your pluggers, and I would also hint that you might get an assistant to fill your patients' teeth for you; one of the sort whose pluggers do not slip.

PLEASE DON'T IMAGINE that I am arguing against the principle of sterilization. On the contrary, if you really grasp my point, you will comprehend that I am recommending more sterilization; more scientific sterilization. I take it for granted that you generally trust your office girl to sterilize your instruments. But that also can be carried to an extreme. Let me be more explicit.

WHAT WOULD you think if your wife hired a cook that cooked the whole dinner in one pot? I don't allude to breakfast, because maybe all you have for breakfast is (or are, which is it) two eggs, or perhaps three; and I suppose three eggs can be cooked in one pot just as well as two. But dinner is different. For dinner you have clams; turtle soup; filet of sole; sweetbread croquettes; filet mignon with asparagus on the side; Philadelphia capon, accompanied by sugared sweet potatoes; escarole salad; biscuit tortoni, cakes, fruit, nuts and raisins, coffee, cheese and crackers. Of course, on company days you might have more; but on wash days you have a plain dinner like that. Now, as I said before, how would you like it if your cook cooked all that dinner in one pot? Would you raise her wages? Would you think her an expert? If you would, I wouldn't.

NOW ISN'T IT the same with your office girl? Don't you think she ought to know the difference between a bacillus and a micrococcus, and which one can swim the longest in boiling water? Don't you think she ought to be able to tell the difference between a Bacterium and a potato bug?

And don't you know a few dentists who could not discriminate between the two? The Fellow under you and the one across the hall, for example. Of course, you know, and I know, but those other fellows—do they know? And coming back home, does your office girl know?

WHY SHOULD SHE, you ask? Well, I'll tell you. A germ is a germ in Germany, and a germ is a germ in France, except perhaps in Paris, where it would be a Parisite. A germ is a germ in England, but in Ireland it is a microbe. In America they are all germs, whether micrococcus, bacillus or vibrio. But when you come to boiling, it is essential to know whether to apply the French, the German or the Irish style of cooking. And the primary requisite in all cooking schools is to know what one is cooking.

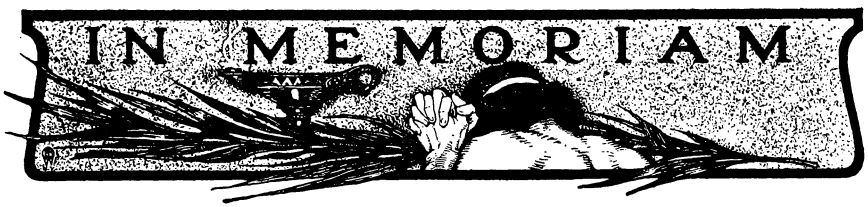
IN STERILIZATION, therefore, the Lady Sterilizer will much more completely accomplish results if she knows whether the instruments are merely under suspicion, or whether they are really infected. In the latter case her boiling will be the more thorough if she knows the dangerous nature of the micro-organism that has infected the instrument, and that the instrument is such that it would innoculate the next patient upon whom it might be used if sterilization be not thorough. Thus knowledge and discrimination become essential to the art of true sterilization.

A LOT MIGHT also be said about the sterilization of the dentist himself. I will mention one fact that may give food for thought. To afford some idea of the size of a Bacterium it has been said that a Bacterium compares in bulk to a man as a grain of sand does to the tallest mountains.

IN THIS CONNECTION, as my paper is not quite used up, I may record one more item of interest. A good bacteriologist has calculated that in twenty-four hours a single Bacterium may divide and subdivide and multiply to the number of 16,777,200. I doubted this statement, so I caught a Bacterium once and watched and counted him for twenty-four hours, and I found that really he amounted by that time to 16,777,201, which shows how careless some so-called scientists are. Perhaps you think that first man's estimate was near enough? But if that extra Bacterium that I found happened to get into your system and you failed to locate him for about a week, you would sing a different song.

NOW, THEN, if Bacteria are as small as that and multiply as fast as that, anybody can see at a glance that boiling Bacteria is not just like other laundry work. It must be done intelligently. I leave the subject, with this problem for the mathematicians of the profession: If it requires ten or fifteen minutes to sterilize a steel instrument by boiling, how long ought a dentist to boil his hands after handling putrescent conditions in the mouth? Answers should be addressed to the Puzzle Editor.

The Pessimist.



Charles Wesley Stainton.

Died at his residence in Buffalo, N. Y., on June 6, 1906, after a brief illness, Dr. Charles Wesley Stainton in the 67th year of his age. Dr. Stainton was born at Castile, Wyoming County, N. Y., on the 9th day of December, 1839, and was the fifth son of the Rev. John and Lydia Griswood Stainton, who came from England and settled in the above township in 1819. Charles Wesley grew to manhood on his father's farm, receiving such education as the district school afforded and afterward graduating from the Perry Academy. For some six months after leaving school, he was a clerk in a drug store in the village of Perry, where he became acquainted with Dr. H. M. Scranton, in whose office Dr. Stainton acquired his first knowledge and rudiments of dentistry. In October, 1864, being then 25 years of age, he entered the dental office of Drs. Quigley and Daboll at Danville, where he remained till January 1, 1866, when he opened an office on his own account for the practice of dentistry in the village of Alden, Erie County, and some six months later another office in Lancaster, and for a time divided his attentions between the two offices. Subsequently the Alden office was closed and his entire time was given to practice in Lancaster, until October, 1872, when he removed to Buffalo, N. Y., and formed an association with Dr. A. P. Southwick at No. 11 Niagara Street, and for the ensuing thirty-four years, was an honored and successful practitioner of that city. During the winter of 1870-71 Dr. Stainton matriculated in the medical department of the University of Buffalo, attending one course of lectures, and the following winter was spent at the Pennsylvania College of Dental Surgery, at Philadelphia, Pa., from which institution he graduated with the degree of D.D.S. in March, 1872. In June of the same year he passed the examination and received the degree of Master of Dental Surgery from the Dental Society of the State of New York. In 1867, at a meeting held in Lockport, Niagara County, Dr. Stainton became a member of the "Dental Association of Western New York," and in 1868 a member of the "Eighth District Dental Society," which Society

he served as President in 1877, and subsequently treasurer for 20 years. In 1872 he became a member of the "Buffalo Dental Association," served as President in 1875 and treasurer for 14 years thereafter. He was a member for many years of the Dental Society of the State of New York, and in 1898 was elected its treasurer in which office he served until the time of his death. He was also a permanent member of the National Dental Association. In all these Dental Societies, Dr. Stainton was an earnest and influential member, presenting many papers which were widely read and discussed, and no greater evidence of the confidence and esteem in which he was held by his professional brethren, could be given than the fact that he was for so many consecutive years unanimously elected to the office of treasurer.

His personal and private life was exemplary throughout and widely influential in many directions. As might have been expected from his parental care and training in childhood, he at an early age united with the Methodist Episcopal Church (in which denomination his father was a minister) and on coming to Buffalo, identified himself with the Delaware Avenue Methodist Church where he remained a useful and highly esteemed member to the time of his death, having served it as trustee for more than a quarter of a century and also chorister of the Sunday-school and mid-week service for nearly as many years.

In November, 1875, Dr. Stainton married Sarah Waith, daughter of the Rev. Wm. Waith, D.D. of Lancaster, N. Y., who, together with two daughters, Ruth L and Edna and one son, Wm. Waith, survive him. In all the walks of life Dr. Stainton was a most exemplary citizen, a warm-hearted and sympathetic friend, whose life was given for the betterment of mankind and the advancement of his chosen profession, and it was a life of great usefulness in both these directions. An unusually wide circle of friends and professional acquaintances mourn his loss. C. S. B.

Buffalo, June 29, 1906.

SOCIETY ANNOUNCEMENTS

National Society Meetings.

American Society of Orthodontists, New York, December, 1906.
Interstate Dental Fraternity, Atlanta, Ga., September 17.
Institute of Dental Pedagogics, Chicago, December 27, 28, 29.
National Association of Dental Examiners, Atlanta, Ga., September 14, 15, 17.
National Association of Dental Faculties, Atlanta, Ga., September 14.
National Dental Association, Atlanta, Ga., September 18.

The Colorado State Dental Association.

The Twentieth Anniversary Meeting of the Association was held in Denver, at the Brown Palace Hotel, on June 19, 20 and 21. The meeting was a notable one, the essays and clinics being of unusual interest. A large attendance and keen interest was had throughout the sessions. Colorado Springs was chosen as the next meeting place.

Newly elected officers are as follows:

Dr. J. Allen Smith, *President,* Colorado Springs.
Dr. G. A. Dille, *Vice-President,* Denver.
Dr. B. Frank Gray, *Secretary,* Colorado Springs.
Dr. Wm. Smedley, *Treasurer,* Denver.